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INSTALLATION RESTORATION PROGRAM

Preliminary Assessment

123rd Tactical Airlift Wing
Kentucky Air National Guard
Standiford Field
Louisville, Kentucky

November 1989

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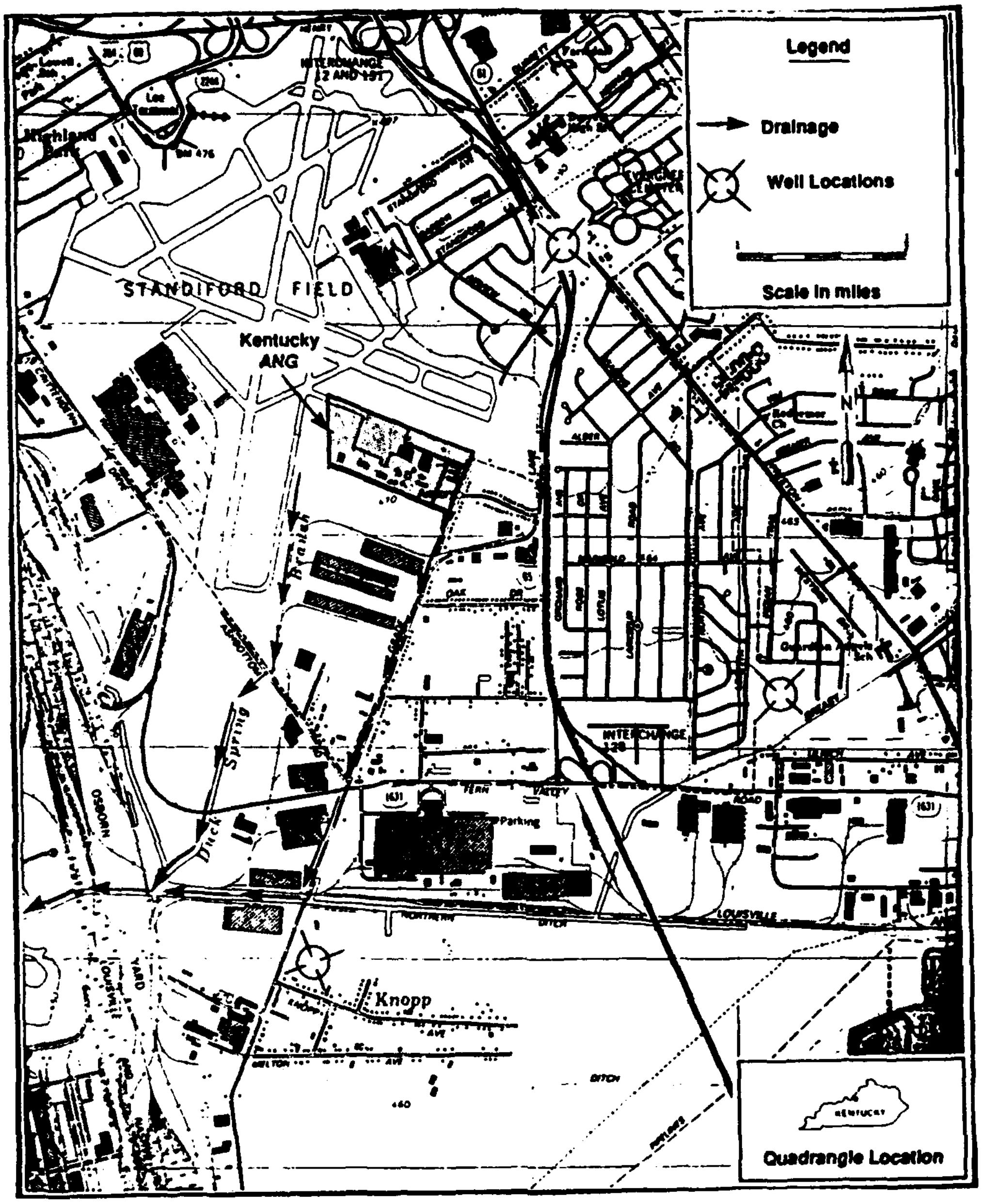

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PRELIMINARY ASSESSMENT

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KENTUCKY AIR NATIONAL GUARD
STANDIFORD FIELD
LOUISVILLE, KENTUCKY

November 1989

Prepared for

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ACRONYM LIST

AGE	-	Aerospace Ground Equipment
ANG	-	Air National Guard
DEQPPM	-	Defense Environmental Quality Program Policy Memorandum
DoD	-	Department of Defense
DRMO	-	Defense Reutilization and Marketing Office
EPA	-	Environmental Protection Agency
FR	-	Federal Register
FTA	-	Fire Training Area
HARM	-	Hazard Assessment Rating Methodology
HAS	-	Hazard Assessment Score
HM/HW	-	Hazardous Materials/Hazardous Wastes
HMTC	-	Hazardous Materials Technical Center
IRP	-	Installation Restoration Program
MAC	-	Military Airlift Command
MEK	-	Methyl Ethyl Ketone
MIBK	-	Methyl Isobutyl Ketone
MSD	-	Metropolitan Sewer District
NDI	-	Nondestructive Inspection
OWS	-	Oil Water Separator
PA	-	Preliminary Assessment
PCB	-	Polychlorinated Biphenyl
PE	-	Professional Engineer
PG	-	Professional Geologist
POC	-	Point of Contact
POL	-	Petroleum, Oil, and Lubricant
RD&D	-	Research, Development, and Demonstration
RD/RA	-	Remedial Design/Remedial Action
SI/RI/FS	-	Site Investigation/Remedial Investigation/ Feasibility Study
TAW	-	Tactical Airlift Wing
TRW	-	Tactical Reconnaissance Wing
UPS	-	United Parcel Service
USAF	-	United States Air Force
USDA	-	United States Department of Agriculture
UST	-	Underground Storage Tank

FOREWORD

This Preliminary Assessment (PA) document was originally prepared for the National Guard Bureau (NGB) by the Hazardous Materials Technical Center (HMTC), operated by the Dynamac Corporation. HMTC's contract for conducting PAs ended prior to completion of the final PA document. Subsequently, the NGB requested completion of this PA under an existing contract with the Hazardous Waste Remedial Actions Program (HAZWRAP) Support Contractor Office, operated by Martin Marietta Energy Systems, Inc. for the U.S. Department of Energy. In turn, HAZWRAP subcontracted with Science and Technology, Inc. for completion of the PA document. Science and Technology, Inc. successfully completed this document in November 1989.

Science and Technology, Inc. produced the final document primarily by addressing comments generated by the NGB through review of HMTC draft documents. Since HMTC conducted the PA and prepared the original PA manuscript, the content of this document is principally a reflection of HMTC's efforts.

EXECUTIVE SUMMARY

A. Introduction

The Hazardous Materials Technical Center (HMTC) was retained in August 1988 to conduct the Installation Restoration Program (IRP) Preliminary Assessment (PA) of the 123rd Tactical Airlift Wing (TAW), Kentucky Air National Guard, Standiford Field, Louisville, Kentucky (hereinafter referred to as the Base), under Contract No. DLA 900-82-C-4426. The PA included:

- an on-site visit, including interviews with 26 past and present Base employees (conducted by HMTC personnel during August 22 - 26, 1988);
- the acquisition and analysis of pertinent information and records on hazardous material use and hazardous waste generation and disposal at the Base;
- the acquisition and analysis of available geologic, hydrologic, meteorologic, and environmental data from pertinent Federal, State, and local agencies; and
- the identification of sites on the Base that are potentially contaminated with hazardous materials/hazardous wastes (HM/HW).

B. Major Findings

Past Base operations involved the use and disposal of materials and wastes that were subsequently categorized as hazardous. Base shops that used and disposed of HM/HW include Civil Engineering; Corrosion Control; Power Production; Aircraft Maintenance; Engine Shop; Aerospace Ground Equipment (AGE) Maintenance; Vehicle Maintenance/ Motor Pool; Fire Department; Supply; Safety; Petroleum, Oils, and Lubricants (POL) Management; Electric Shop; Wheel and Tire Shop; Battery Shops; Nondestructive Inspection (NDI); Fuels; Egress; Pneudralics; Weapons Maintenance; Non-Powered AGE; Machine Shop; Paint Shop; and Photography Laboratory. Waste solvents, fuels, oils, batteries (nickel-cadmium

and lead-acid), battery acid, paint thinners, and strippers [some containing methyl ethyl ketone (MEK) and methyl isobutyl ketone (MIBK)], penetrant, emulsifier, cleaning compounds, photographic chemicals, and ethylene glycol were generated by these activities.

Interviews with past and present Base personnel and a field survey resulted in the identification of one potential site at the Base that may be contaminated with HM/HW. This site was assigned a Hazard Assessment Score (HAS) according to the U.S. Air Force Hazard Assessment Rating Methodology (HARM). The following is a brief description of this potential site:

Site No. 1 - Fire Training Area (FTA)

The Base conducted fire training activities at this site (Figure 5) from 1958 to 1972. This FTA was unbermed and used three to six times per year. JP-4, stored in 55-gallon drums west of the FTA, and gasoline were the primary fuels for training burns. However, solvents, strippers containing MEK and MIBK, and trichloroethane were also disposed of by burning at this site. Waste oil, carbon cleaner, and thinners may have been used. A typical training burn consisted of pouring and igniting 300 - 500 gallons of collected wastes directly on the ground without prior water saturation of the soil.

As many as 12,600 gallons of residual wastes may have contaminated the soil and shallow groundwater at this site. However, a field inspection revealed no visible evidence of contamination such as soil discoloration or stressed vegetation.

Aerial photographs and maps indicate that the pad for the current Engine Test Stand was constructed over part of this FTA. The stand's foundation was placed on 1 - 3 feet of fill. There is no documented removal of soil from the FTA during construction.

C. Conclusions

Information obtained through interviews with past and present Base personnel resulted in the identification

of one potential site [Site No. 1 - Fire Training Area (FTA)] on the Base that may have been contaminated with HM/HW. The potential exists for contamination of soils, surface water, or groundwater and subsequent contaminant migration from this site. This site was therefore assigned a HAS according to HARM.

D. Recommendations

Further IRP investigations are recommended for Site No. 1- Fire Training Area (FTA).

I. INTRODUCTION

A. Background

The 123rd Tactical Airlift Wing (TAW) of the Kentucky Air National Guard, located at Standiford Field, Louisville, Kentucky (hereinafter referred to as the Base) provides air photo support for reconnaissance missions. Past operations at the Base involved the use and disposal of materials and wastes that subsequently were categorized as hazardous. Consequently, the National Guard Bureau has implemented its Installation Restoration Program (IRP). The IRP consists of the following:

- o Preliminary Assessment (PA) - to identify past spill or disposal sites posing a potential and/or actual hazard to public health or the environment.

- o Site Investigation/Remedial Investigation/ Feasibility Study (SI/RI/FS) - to acquire data via field studies for the confirmation and quantification of environmental contamination that may have an adverse impact on public health or the environment and to select a remedial action through preparation of a feasibility study.

- o Research, Development, and Demonstration (RD & D) - if needed, to develop new technology to accomplish remediation.

- o Remedial Design/Remedial Action (RD/RA) - to prepare designs and specifications and to implement site remedial action.

B. Purpose

The purpose of this PA is to identify and evaluate suspected problems associated with past hazardous waste handling procedures, disposal sites, and spill sites on the Base. Personnel from the Hazardous Materials Technical Center (HMTC) visited the Base, reviewed existing environmental information, analyzed Base records concerning the use and generation of hazardous

materials/hazardous wastes (HM/HW), and conducted interviews with past and present Base personnel familiar with past hazardous materials management activities.

A physical inspection was made of various facilities and suspected sites. Relevant information collected and analyzed as part of the PA included the Base history; local geologic, hydrologic, and meteorologic conditions that may affect contaminant migration; local land use and public utilities that could affect the potential for exposure to contaminants; and the ecologic settings that indicate environmentally sensitive habitats or evidence of environmental stress.

C. Scope

The scope of this PA is limited to operations at the Base and includes:

- An on-site visit;
- The acquisition of pertinent information and records on hazardous materials use, hazardous wastes generation, and disposal practices at the Base;
- The acquisition of available geologic, hydrologic, meteorologic, land use, critical habitat, and utility data from various Federal, State, and local agencies;
- A review and analysis of all information obtained; and
- The preparation of a report to include recommendations for further actions.

The on-site visit and interviews with past and present Base personnel were conducted during the period August 22 - 26, 1988. The PA was conducted by Ms. Betsy Briggs, Project Manager/Hazardous Waste Specialist and Mr. Raymond Clark, PE, Department Manager. Other HMTC personnel who assisted with the PA included Mr. Mark Johnson, PG, Program Manager; Ms. Janet Emry, Hydrogeologist; and Ms. Natasha Brock, Environmental Scientist (Appendix A). Personnel from the Air National

Guard Support Center who assisted in the PA included Mr. Greg Krisanda and Ms. Carol Ann Beda, Project Officers. The Point of Contact (POC) at the Base was Lt. Phillip R. Howard, Base Environmental Coordinator.

D. Methodology

Figure 1 is a flow chart of PA methodology. This methodology ensures a comprehensive collection and review of pertinent, site-specific information and is used in the identification and assessment of potentially contaminated hazardous waste spill/disposal sites.

The PA begins with a site visit to the Base to identify all shop operations or installation activities that may use hazardous materials or generate hazardous wastes. Next, past and present HM/HW handling procedures are evaluated to determine whether any environmental contamination has occurred. This evaluation is facilitated by extensive interviews with past and present employees familiar with the various operating procedures at the Base. These interviews also define the areas on the Base where any HM/HW, either intentionally or inadvertently, may have been used, spilled, stored, disposed of, or otherwise released into the environment.

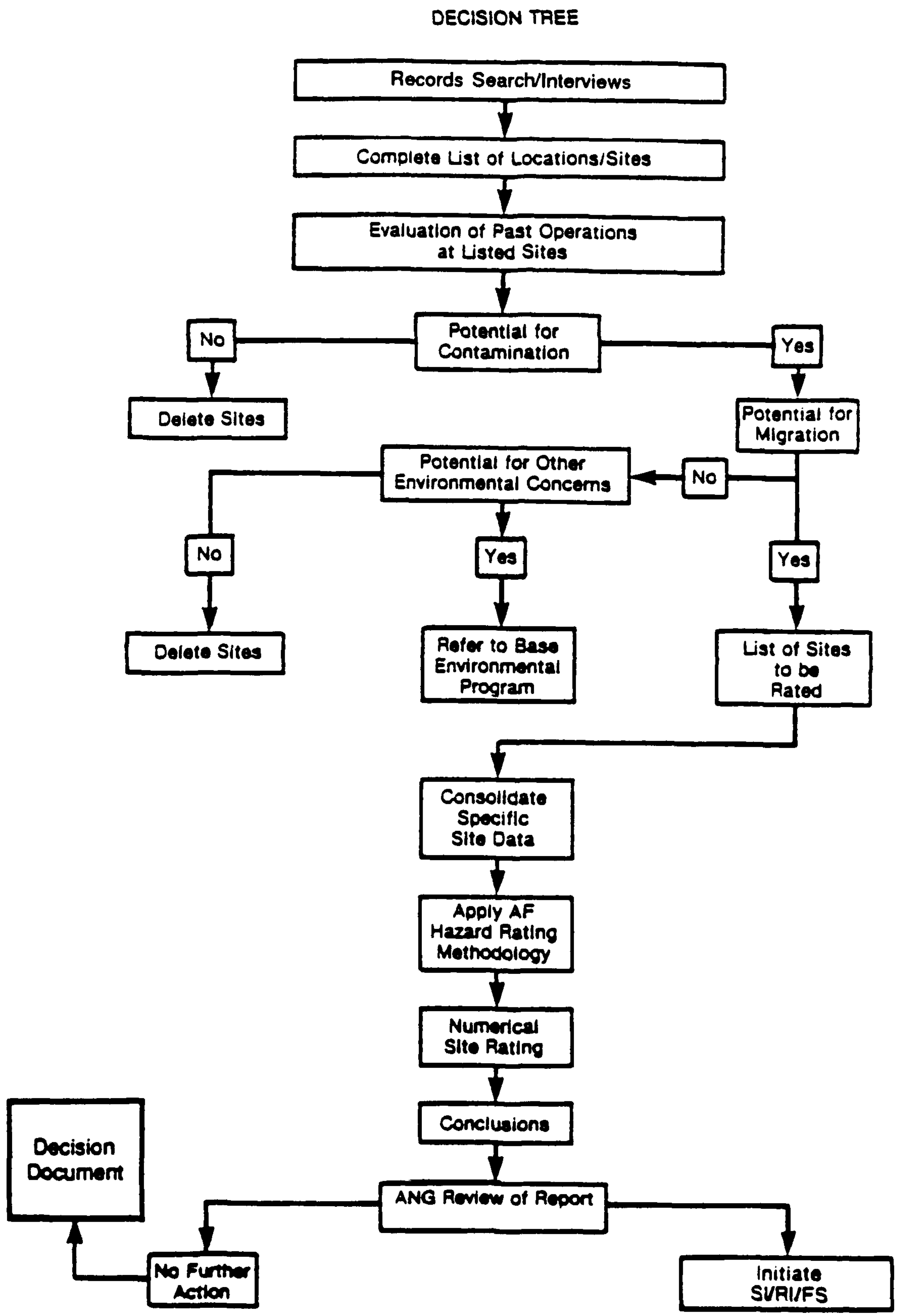
Historic records from Base files are collected and reviewed to supplement information from interviews. Using this information, past waste spill/disposal sites on the Base are identified for further evaluation. A survey tour of these sites, the Base, and the surrounding area is conducted to identify visible evidence of contamination and to help assess the potential for contaminant migration. Particular attention is given to locating nearby drainage ditches, surface water bodies, residences, and wells.

Detailed geologic, hydrologic, meteorologic, land use, and environmental data for the study area are also obtained from the POC and from appropriate Federal, State, and local agencies. Appendix B contains a list of outside agencies contacted. Following a detailed analysis of all information, areas where HM/HW disposal and/or spills may have occurred are identified as suspect. Where sufficient information is available, sites are assigned a Hazard Assessment Score (HAS) using the U.S. Air Force Hazard Assessment Rating Methodology

HMTC PRELIMINARY ASSESSMENT INSTALLATION RESTORATION PROGRAM

Figure 1.

Preliminary Assessment Methodology Flow Chart.



(HARM) (Appendix C). However, the absence of a HAS does not necessarily negate a recommendation for further IRP investigation, but rather, may indicate a lack of data. The HAS is computed from the data included in the Factor Rating Criteria (Appendix D).

II. INSTALLATION DESCRIPTION

A. Location

The 123rd Tactical Airlift Wing (TAW), Kentucky Air National Guard, Standiford Field, Louisville, Kentucky, is located on the east side of Standiford Field. The Base is approximately 5.5 miles southeast of Louisville. Figure 2 is a location map of this general area.

Residential areas are located immediately north and east of Standiford Field. Commercial and Industrial areas are located south and west of Standiford Field.

The residential population within a 1-mile radius of the Base is calculated by using the Louisville East, Kentucky, Quadrangle Topographic Map, 1982 and by assuming each dwelling unit has 3.8 residents (47 FR 31233). The residential population within a 1-mile radius of the Base is 1345, and the Base population is 1200 on unit training assembly weekends. There are approximately 300 full-time technicians. The total population within the 1-mile radius is substantially greater than 1000.

B. History of the Base

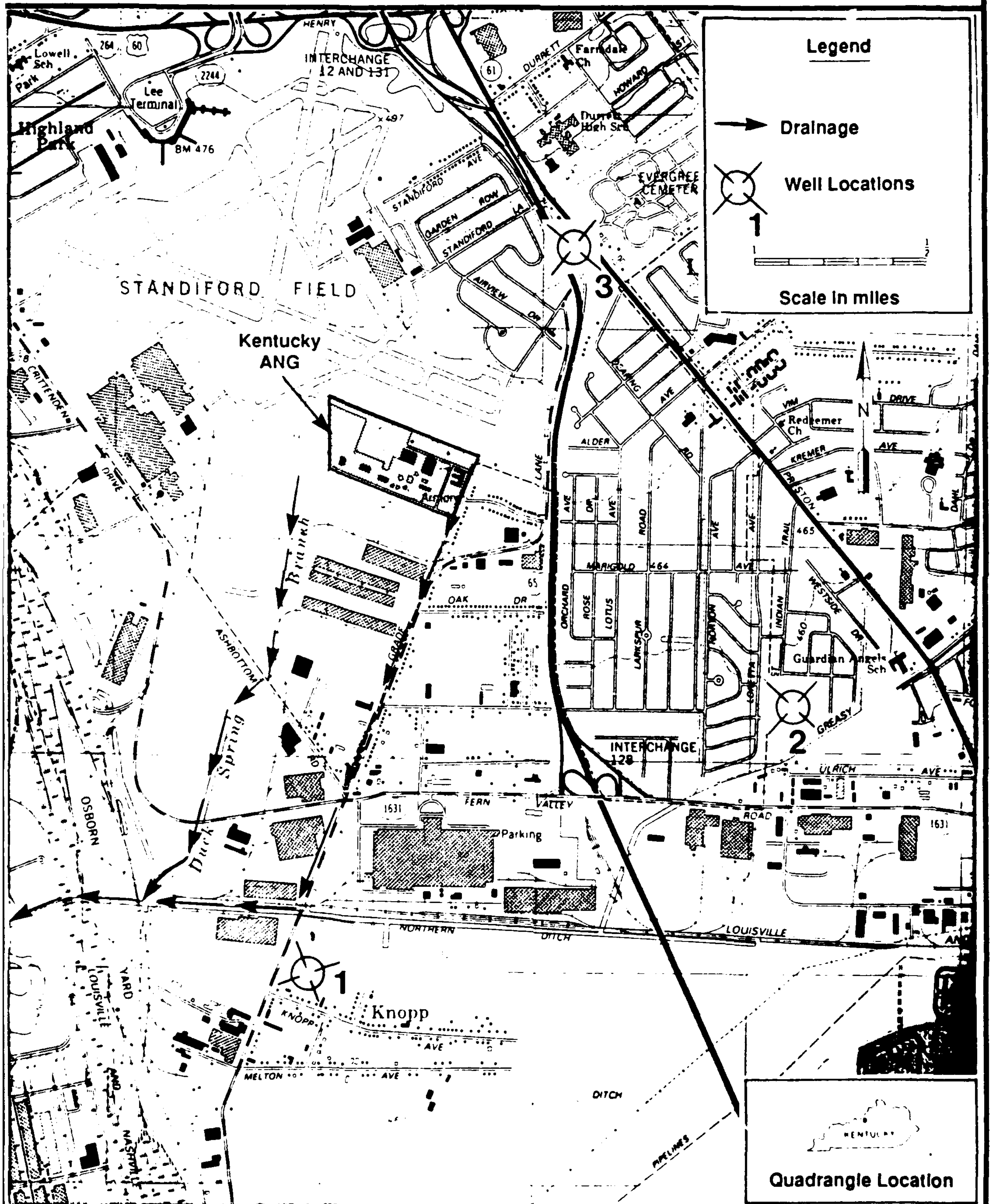
The current Base at Standiford Field was constructed on a wetland area by the U.S. Army Corps of Engineers in 1958. At this time, the 123rd Tactical Fighter Group, located at the Bremener Biscuit location on the northwest side of Standiford Field, moved to Standiford Field with a designation change to the 123rd Tactical Airlift Wing. With this new designation and a new mission, the RB-57 "Canberra" became the main aircraft in use at the Base. As many as 16 of these aircraft were in use at the Base from 1958 to 1965. C-47s were used as support aircraft during this period.

In 1965 the RF-101 "Voodoo" replaced the RB-57. During the period 1965 - 1976, the tactical reconnaissance mission continued with 18 RF-101s. In 1966 the C-47s were replaced by C-54 aircraft. The C-54 support aircraft were replaced in 1975 by a single C-131. One C-54 was also in use as a support aircraft from 1966 to 1976.

Source: U.S.G.S. Topographical Map 7.5 Minute Series Louisville East Quadrangle Kentucky Jefferson, Co., 1982.

Figure 2.

Location Map of the 123rd TAW, Kentucky Air National Guard, Standiford Field, Louisville, Kentucky.



In the spring of 1976, a no-notice conversion to the RF-4C "Phantom II" aircraft was announced by the National Guard Bureau. Eighteen of these aircraft were devoted to tactical reconnaissance activities from 1976 to 1984. During the period 1984 - 1988 twenty-four RF-4 were used. A single C-131 and one C-12 support aircraft were used at the Base during this period. The C-12 aircraft replaced the C-131 in 1985.

On January 1, 1989, another mission change occurred at the Base. The 123rd Tactical Airlift Wing was redesignated as the 123rd Tactical Airlift Wing under the Military Airlift Command (MAC). At that time, the Base converted to use of the C-130.

Changes in aircraft and mission are responsible for many operational changes, including changes in quantities, types, and methods of disposal of hazardous materials. An aircraft conversion is often accompanied by variations in routine maintenance. Changing the engine oil, testing the engine, lubricating the plane, and washing the aircraft are just a few maintenance operations that could change.

Operational changes also occur because of changes in policies, standards, personnel, and technology. Liquid and solid wastes that were once disposed of in the environment are now recycled or disposed of by contractors. Oil water separators have greatly reduced the amount of liquid wastes released into the environment. Also, the awareness of hazardous materials has further reduced environmental impacts, as has the introduction of substances such as biodegradable compounds. The majority of hazardous wastes are now collected and disposed of through the Defense Reutilization and Marketing Office (DRMO).

III. ENVIRONMENTAL SETTING

A. Meteorology

The meteorological data presented in this section are from local climatological records compiled by the U.S. Department of Agriculture (USDA) for Jefferson County, Kentucky. Temperature, precipitation, wind, and humidity in the area are wide ranging.

The temperature normally reaches $90^{\circ}F$ or higher 49 days per year; $100^{\circ}F$ is usually reached once each year during June, July, August, or September. Temperatures of $32^{\circ}F$ or lower occur on the average of 92 nights per year. The temperature drops below $0^{\circ}F$ on the average of less than once each winter.

Daytime temperatures normally rise above $32^{\circ}F$ approximately 351 days per year. During cold weather, a daily freeze-thaw cycle is typical.

Thunderstorms are most frequent from March through November. Short, intense rainfalls occur during the summer months. Longer, less intense rains; which may result in local flooding due to frozen, snow-covered, or saturated soils; occur in the spring.

During the winter, the ground is seldom snow-covered for more than a few days. Rarely are there more than five snowfalls per year that yield more than 1 inch.

The average annual precipitation is 41.32 inches. The net precipitation is calculated by subtracting the mean lake evaporation from the average annual precipitation according to the method outlined in the Federal Register (47 FR 31224). The mean annual lake evaporation is 35 inches, and therefore, the net precipitation value is 6.32 inches per year. Maximum rainfall intensity, based on a 1-year, 24-hour rainfall, is 2.5 inches (47 FR 31235).

B. Geology

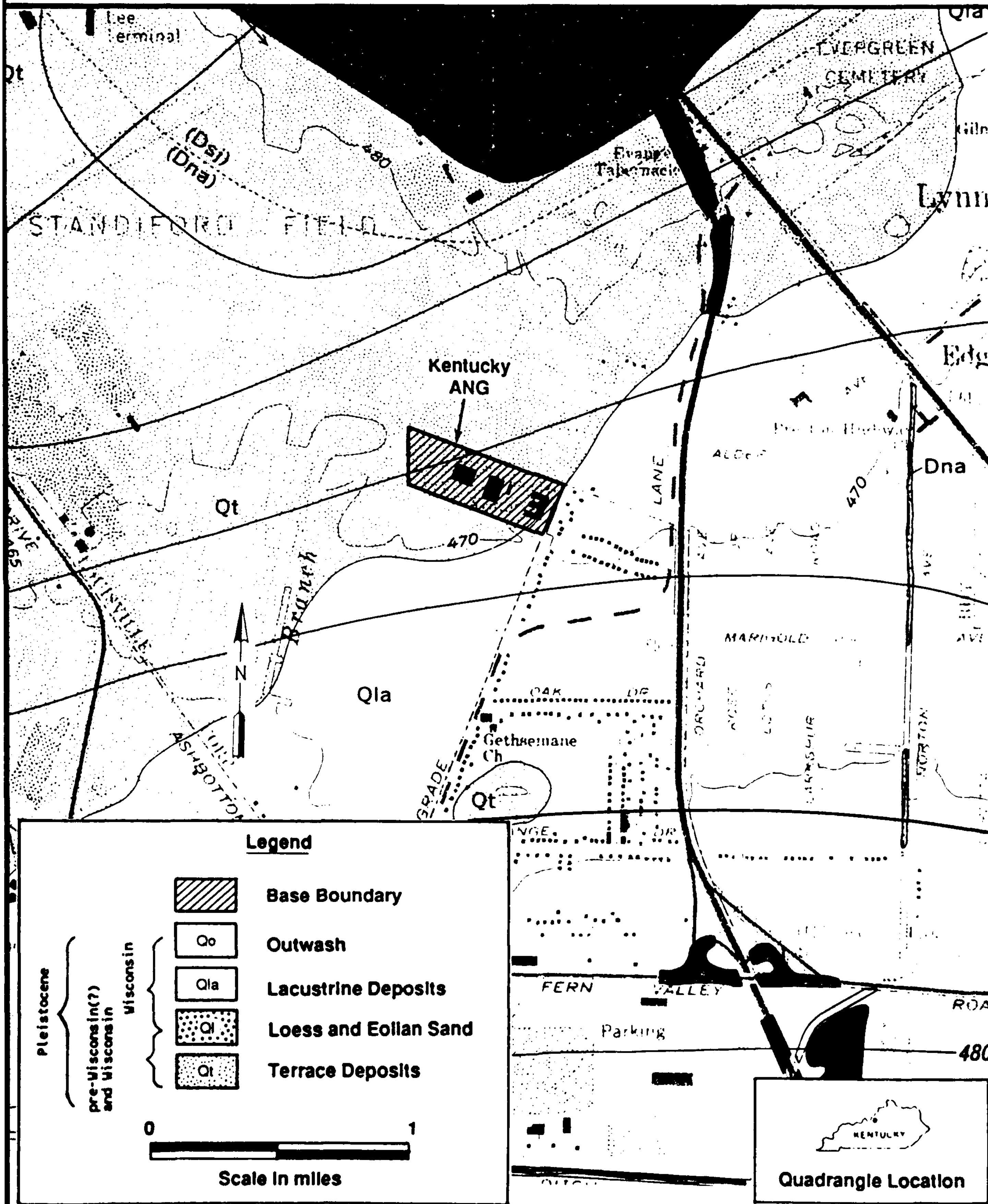
The surficial geology of the Standiford Field area (Figure 3A) is primarily Pleistocene (Pre-Wisconsin and Wisconsin) terrace deposits. A small area on the

HMTC

Source: U.S.G.S. Geologic Map of the Louisville East Quadrangle, Jefferson County, Kentucky. Map GQ–1203, 1974.

Figure 3A.

Geologic Map of the Louisville East Quadrangle, Jefferson County, Kentucky.



southeastern side of the Base is underlain by Wisconsin lacustrine deposits (Kepferle, 1974).

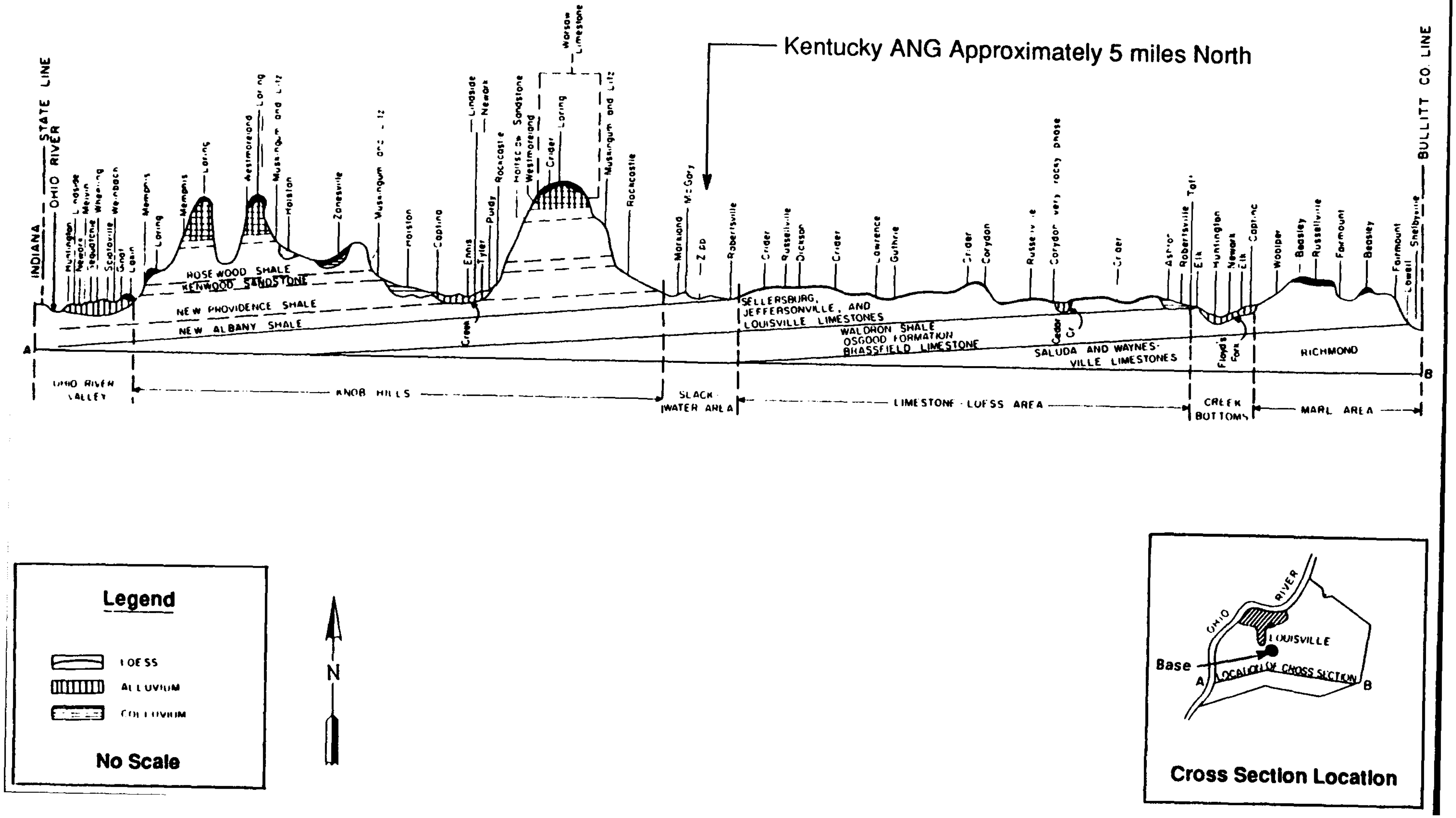
The lacustrine deposits in the southeastern section of the Base range in thickness from 0 to 50+ feet and consist of clay, silt, sand, and gravel. The clay and silt appear to be calcareous when freshly exposed, and their colors range from gray and olive-gray to bluish-green. When weathered, they are dark yellowish-orange to moderate yellowish-brown. They may contain abundant plant remains. This unit was deposited in valleys ponded by glacial outwash that filled the Ohio River Valley. The unit interfingers up valleys; in particular, those of the middle and south forks of Beargrass Creek; with deposits of alluvium and colluvium. In the lower reaches of this valley, loess and outwash deposits are found (Kepferle, 1974).

Most of the Base is underlain by Pleistocene terrace deposits that range in thickness from 0 to more than 20 feet. These deposits consist of silt, clay, sand, and gravel along valleys tributary to the Ohio River. They range in color from dark to yellowish-brown. They are of mixed fluvial, eolian, and lacustrine origin. The basal 3 feet contains granules and pebbles of iron-cemented siltstone in a clayey silt matrix (Kepferle, 1974).

Underlying the surficial deposits is the New Albany Shale, which is of Devonian age. This formation ranges in thickness from 90 to 105+ feet and consists of shale that is silty and carbonaceous. It appears massive where fresh and weathers into thin, brittle chips. Colors range from olive to grayish-black and weather to pale yellowish-brown to very light gray. The unit is usually covered by surficial deposits. Isolated sections are exposed along drainage ditches and excavation sites. Underlying the New Albany Shale are the Devonian to Mid-Silurian Age Sellersburg, Jeffersonville, and Louisville limestones.

Figure 3B shows geologic formations and related soils from a diagrammatic east-west cross section of Jefferson County, Kentucky. This cross section is approximately 5 miles south of the Base and is representative of the stratigraphy of the region.

Excavations and soil borings (Appendix F) on the Base show layers of clay and silt ranging in colors from brown and tan to gray. Shale bedrock (New Albany Shale)


Kentucky ANG Approximately 5 miles North
INDIANA
STATE LINE
OHIO RIVER
BULLITT CO. LINE
ROSEWOOD SHALE
KENWOOD SANDSTONE
NEW PROVIDENCE SHALE
NEW ALBANY SHALE
SELLERSBURG, JEFFERSONVILLE, AND LOUISVILLE LIMESTONES
WALDRON SHALE
OSGOOD FORMATION
BRASSFIELD LIMESTONE
SALUDA AND WAYNESVILLE LIMESTONES
RICHMOND
OHIO RIVER VALLEY
KNOB HILLS
SLACK WATER AREA
LIMESTONE - LOESS AREA
CREEK BOTTOMS
MARL AREA
Warsaw Limestone
Legend
LOESS
ALLUVIUM
COLLUVIUM
No Scale
N
OHIO RIVER
LOUISVILLE
Base
LOCATION OF CROSS SECTION
Cross Section Location

underlies these beds at 7 to 15 feet below the land surface.

C. Soils

According to the USDA, Soil Conservation Service (Zimmerman, 1966), Standiford Field lies within the Zipp-Robertsville soil association (Figure 3C), which occurs on broad, poorly drained flats in a slack water area that is dissected by two large drainage ditches and several small ones. This association has some gently sloping or sloping terraces. The soils are alkaline silty clay or clay settled from an old slack water lake. Older streams and ditch areas may have a more recent overwash of silt loam rims.

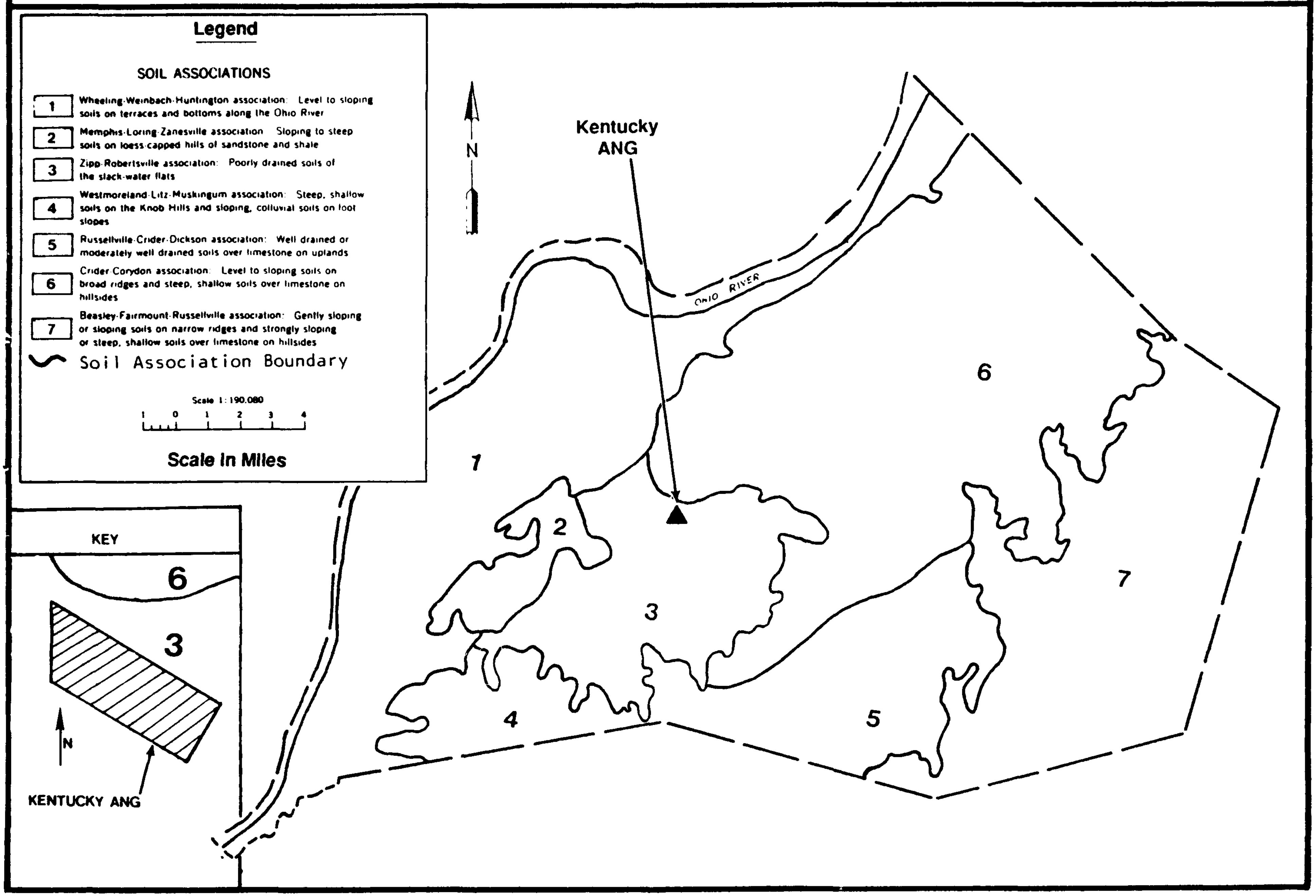
This association extends from Standiford Field to the foot slopes of the Knob Hills and from Newburg to Third Street Road. The northern edge is within the city limits of Louisville. The total acreage of this association covers 11 percent of Jefferson County. Fifty-five percent of this association consists of Zipp soils, 20 percent of the association consists of Robertsville soils, and 25 percent are minor soils.

Zipp soils are deep and poorly drained and are found in the slack water area. The surface layer is dark-gray silty clay. The subsoil is mottled gray and brown calcareous clay. This soil has very slow surface drainage and permeability. The following is a representative profile:

0 to 7 inches:	dark-gray silty clay.
7 to 21 inches:	dark-gray to gray clay; many brown and dark-brown mottles; strong, blocky structure; sticky and very plastic when wet.
21 to 24 + inches:	mottled gray, yellowish-brown, and brown clay; strong, blocky structure; sticky and very plastic when wet.

Soil Survey, Jefferson County, Kentucky, June 1966.

General Soil Map of Jefferson County, Kentucky.



For Zipp silty clay, the surface permeability is low, 0.2 to 0.8 in/hr (1.4 X 10^{-4} to 5.6 X 10^{-4} cm/sec). For the underlying Zipp clay, the permeability is also low, 0.05 to 0.20 in/hr (3.5 X 10^{-5} to 1.4 X 10^{-4} cm/sec).

Zipp soils are not prone to erosion because of the flat areas in which they occur. Therefore, surface erosion will be rated as "none" for the purpose of calculating HARM scores.

Robertsville soils are deep, poorly drained, and found on terraces. The surface soil is grayish-brown silt loam. The subsurface soil is mottled gray, brownish-gray, and yellowish-brown silty clay loam. The compact fragipan is at a depth of 16 to 18 inches. The following is a representative profile:

0 to 6 inches:	grayish-brown, friable silt loam; few gray mottles.
6 to 15 inches:	gray silt loam; many brown mottles; weak, blocky structure.
15 to 38 inches:	mottled gray and yellowish-brown silty clay loam; compact and brittle (fragipan).

The permeability of surface Robertsville silt loam is low, 0.2 to 0.8 in/hr ((1.4 X 10^{-4} to 5.6 X 10^{-4} cm/sec). For the underlying silt loam and silty clay loam, the permeability for both is low, 0.05 to 0.20 in/hr (3.5 X 10^{-5} to 1.4 X 10^{-4} cm/sec).

Robertsville soils are not prone to erosion because of the flat areas in which they occur. Therefore, surface erosion will be rated as "none" for the purpose of calculating HARM scores.

The minor soils are poorly drained to moderately well drained McLeary and Markland soils. These soils were formed on terraces in highly alkaline alluvium. There is also an overwash phase of Zipp soils in this association. These soils have a recent 8 to 20-inch deposit of silt loam over their normal profile.

In general, this association is not well suited to urban development, but the area does have small and large

industries and subdivisions. If the sewage lines were extended in conjunction with deepening and extending the drainage ditches, industrial usage would increase.

Soil borings taken on Base (Appendix F) generally consisted of brown, tan, and gray silty clay. Bedrock was encountered at depths ranging from 7 to 15 feet.

D. Hydrology

Surface Water

Duck Spring Branch, located approximately 500 feet west of the Engine Test Stand on Base property, is the closest surface water body. The Ohio River is approximately 6 miles northwest of Standiford Field.

Surface drainage on the Base follows one of two paths, depending on its point of origin. (See Figure 2.) Surface runoff on the eastern side drains off-Base into Grade Lane Ditch. This ditch flows in a southwesterly direction for 1.3 miles where it joins Northern Ditch. Northern Ditch eventually joins Southern Ditch.

Surface runoff on the western side of the Base drains into Duck Spring Branch. Duck Spring Branch flows in a southwesterly direction for 1.3 miles where it joins Northern Ditch. This occurs approximately 0.5 miles west of the Grade Lane Ditch/Northern Ditch intersection. Drainage from this side of the Base and from the eastern side eventually flows into the Ohio River.

According to the U.S. Army Corps of Engineers in Louisville, Base property at Standiford Field does not lie within a 100-year flood plain.

Groundwater

The major aquifer at the Base and in its immediate vicinity occurs within the Ordovician, Silurian, and Late Devonian age limestones. Some groundwater is produced from the shallower, Devonian age New Albany Shale. The overlying Mississippian age shales act as an acquiclude that prevents recharge from the unconfined surficial aquifer. This shallow, unconfined aquifer occurs in the surficial soil and terrace deposits in the Base area.

These aquifers are regionally distributed throughout portions of southern and north-central Kentucky. This information and the other facts in this section were obtained from Faust (1984) and Kiesler et al (1987), unless otherwise noted.

Potable water wells that tap the major aquifers are primarily for domestic and stock use. Well depths range from 50-200 feet and may exceed 300 feet. Typical well yields are 2 to 10 gal/min and may exceed 300 gal/min.

There are three known potable water wells within 1.5 miles of the Base. These wells are illustrated on Figure 2 as Well Nos. 1, 2, and 3. Correspondence with the United States Geological Survey (USGS) [See Appendix B.] indicated that these wells (probably drilled in the 1940s) are very old domestic water sources. USGS well records indicated that Well No. 1 was drilled to a total depth of 30 feet and tapped a groundwater source in the Devonian age New Albany Shale. Well No. 2 was drilled to a depth of 53 feet. It also taps the New Albany Shale. Well No. 3 was drilled to a depth of 15 feet and tapped the Devonian age Sellersburg Formation.

Regionally, groundwater that occurs in the Ordovician, Silurian, and Devonian age limestone aquifer system flows downdip to the west and northwest and discharges into the Ohio River. Shallow groundwater in this aquifer system may discharge locally into some of the Ohio's tributaries.

The shallow, unconfined aquifer within the terrace deposits discharges into the local streams. The shallow water table, which is penetrated on-Base at depths from 0-6 feet, is hydrologically connected to groundwater in the terrace deposits. This water flows to the east and discharges into Grade Lane Ditch. It then flows to the west and discharges into Duck Spring Branch.

Water samples have been collected from Ordovician, Silurian, and Devonian age limestone aquifers and analyzed for water quality. The water is generally fresh but may contain mineral concentrations greater than 250 mg/l. Water from some of the deeper aquifers may contain hydrogen sulfide. The water is also very hard with 90% of the hardness values exceeding 178 mg/l. The median iron concentration is 280 mg/l. The percent of the nitrate concentrations exceeds 8.0 mg/l.

The water supply for the Base is municipal water purchased from the City of Louisville, Louisville Water Department. The Louisville Water Department pumps the majority of its municipal water, approximately 95%, from the Ohio River. A small portion, probably 5% or less, is pumped from a Louisville Water Department test well. This well, which is located approximately 125 feet south of the Ohio River, produces from Ohio River gravel. It was drilled to a total depth of 100 feet and yields 2000 gal/min. (Personal Communication with Mr. Carl Basham, Louisville Water Department).

E. Critical Environments

According to the Commonwealth of Kentucky, Department of Fish and Wildlife Resources, there are no endangered or threatened species of flora or fauna within a 1-mile radius of the Base. Furthermore, no critical habitats, wetlands, or wilderness areas are known to be present in or near Site No. 1 - Fire Training Area (FTA). (See Section IV.)

IV. SITE EVALUATION

A. Activity Review

A review of Base records and interviews with Base personnel resulted in the identification of specific operations at the Base in which the majority of industrial chemicals are handled and hazardous wastes are generated. A total of 26 past and present Base personnel with an average of 20 years experience was interviewed. They represented the following Base shops: Civil Engineering; Aircraft Maintenance; Engine Shop; Vehicle Maintenance/Motor Pool; Corrosion Control; Aerospace Ground Equipment (AGE) Maintenance; Petroleum, Oils, and Lubricants (POL) Management; Photography Lab; Nondestructive Inspection (NDI); Power Production; Supply; Fire Department; Wheel and Tire Shop; Safety; Electrical Shop; Fuels; Egress; Pneudraulics; Weapons Maintenance; Non-Powered AGE; Machine Shop; Paint Shop; and Battery Shop. Table 1 provides estimates of the quantities of wastes that have been generated by these shops and describes past and present waste disposal practices. Any shop that is not listed in Table 1 has been determined to produce negligible quantities of wastes requiring disposal.

B. Disposal/Spill Site Identification, Evaluation, and Hazard Assessment

Interviews with Base personnel and subsequent visual inspections of Base property resulted in the identification of one site potentially contaminated with HM/HW. Figure 4 illustrates the location of this site. The site was assigned a HAS according to HARM (Appendix C). A copy of the completed Hazard Assessment Rating Form is found in Appendix D. The objective of this assessment is to provide a score for relative ranking of sites suspected of contamination by hazardous materials.

The final rating score reflects specific components of the hazard posed by a site: possible contamination receptors (e.g., population within a specified distance from the site and/or critical environments located within a 1-mile radius of the site); the waste and its characteristics; and the potential pathways for contaminant migration (e.g., surface water, groundwater,

Table 1. Hazardous Material/Hazardous Waste Disposal Summary: 123rd TAW, Kentucky Air National Guard, Standiford Field, Louisville, Kentucky

Shop Name and Location	Hazardous Waste/ Used Hazardous Material	Estimated Quantities (Gallons/Year)	Method of Treatment/Storage/Disposal 1950 1960 1970 1980 1988
POL Facility Bldg. No. 00006	JP-4	75	'----------FTA-----------------'-OWS/REC'
Fuels Management Shop Bldg. No. 00019	Sulfuric Acid	<1	'------NEUTR SAN---------------'--DRMO--'
Vehicle Maintenance Shop (Motor Pool) Bldg. No. 00005	Engine Oil	280	'--UNKNOWN--------'-----CONTR---'--DRMO--'
	PD-680	10	'--UNKNOWN--------'-----CONTR---'--NLU---'
	PD-140	<50	'-----------NIU----------------'--DRMO--'
	Sulfuric Acid	40	'--UNKNOWN--------'--NEUTR SAN--'--DRMO--'
	Ethylene Glycol	100	'--UNKNOWN--------'-----STORM---'--DRMO--'
	Hydraulic Oil	10	'--UNKNOWN--------'-----CONTR---'--DRMO--'
	Grease (Bearing)	1	'--UNKNOWN--------'-----CONTR---'--DRMO--'
Weapons Maintenance Shop Bldg. No. 00021	TCE	5	'---------------CONTR----------'--DRMO--'
	MEK	5	'---------------CONTR----------'--DRMO--'
	PD-680	5	'---------------CONTR----------'---NLU--'

KEY:

CONTR	-	Disposed of by a contractor.
DRMO	-	Disposed of through the Defense Reutilization & Marketing Office.
FTA	-	Disposed of at the fire training area.
NEUTR SAN	-	Disposed of through the sanitary sewer, after neutralization.
NIE	-	Shop not in existence.
NIU	-	Not in use.
NLU	-	No longer used.
OWS	-	Disposed of through an oil water separator.
SAN	-	Disposed of in the sanitary sewer.
STORM	-	Disposed of through the storm sewer.
TRASH	-	Disposed of in general refuse.
UNKNOWN	-	Information not supplied nor available.

Table 1. Hazardous Material/Hazardous Waste Disposal Summary: 123rd TAW, Kentucky Air National Guard, Standiford Field, Louisville, Kentucky (continued)

Shop Name and Location	Hazardous Waste/ Used Hazardous Material	Estimated Quantities (Gallons/Year)	Method of Treatment/Storage/Disposal 1950 1960 1970 1980 1988
Aircraft Maintenance Shop Bldg. 00010	PD-680	100	'--UNKNOWN-------'-----CONTR---'---NLU--'
	Trichloroethane	20	'---------------CONTR----------'--DRMO--'
	Strippers (MEK, MIBK)	10	'---------------CONTR----------'--DRMO--'
	JP-4	500	'---------------CONTR----------'--DRMO--'
	PS-661 Solvent	100	'---------------CONTR----------'---NLU--'
	7808 Oil	50	'---------------CONTR----------'--DRMO--'
	Hydraulic Oil	20	'---------------CONTR----------'--DRMO--'
	Cleaning Compound (Alkaline Soap)	300	'----------------SAN-----------'---OWS--'
	PD-140	100	'----------------NIU-----------'--DRMO--'
Nondestructive Inspection Shop Bldg. No. 00023	Penetrant	55	'----------------NIE-----------'--DRMO--'
	Emulsifier	55	'----------------NIE-----------'--DRMO--'
	Developer	55	'----------------NIE-----------'--DRMO--'
	Fixer	20	'----------------NIE-----------'--DRMO--

KEY:

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FTA	-	Disposed of at the fire training area.
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SAN	-	Disposed of in the sanitary sewer.
STORM	-	Disposed of through the storm sewer.
TRASH	-	Disposed of in general refuse.
UNKNOWN	-	Information not supplied nor available.

Table 1. Hazardous Material/Hazardous Waste Disposal Summary: 123rd TAW, Kentucky Air National Guard, Standiford Field, Louisville, Kentucky (continued)

Shop Name and Location	Hazardous Waste/ Used Hazardous Material	Estimated Quantities (Gallons/Year)	Method of Treatment/Storage/Disposal 1950 1960 1970 1980 1988
Battery Shop Bldg. No. 00010	NICAD	300 cells	'----------------NIU------------'--DRMO--'
	Battery Acid	UNKNOWN	'----------------NEUTR SAN--------'--DRMO--'
Machine Shop Bldg. No. 00010	Lubricating Oils	1	'----------------TRASH-----------'--DRMO--'
Paint Shop Bldg. No. 00025	Thinners	20	'--UNKNOWN---------------------'--DRMO--'
	Paint Containers (Residual)	12 cans	'----------------TRASH-----------'--DRMO--'
	Strippers (MEK)	2	'--UNKNOWN---------------------'--DRMO--'
	Strippers (Residual)	UNKNOWN	'----------------TRASH-----------'--DRMO--'
Engine Shop Bldg. No. 00014	PD-680	160	'--UNKNOWN----------'----CONTR---'---NLU--'
	Carbon Cleaner	1	'--UNKNOWN----------'----CONTR---'--DRMO--'
	7808 Oil	100	'--UNKNOWN----------'----CONTR---'--DRMO--'
	Hydraulic Oil	20	'--UNKNOWN----------'----CONTR---'--DRMO--'

KEY:

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NEUTR SAN - Disposed of through the sanitary sewer, after neutralization.
NIE - Shop not in existence.
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OWS - Disposed of through an oil water separator.
SAN - Disposed of in the sanitary sewer.
STORM - Disposed of through the storm sewer.
TRASH - Disposed of in general refuse.
UNKNOWN - Information not supplied nor available.

Table 1. Hazardous Material/Hazardous Waste Disposal Summary: 123rd TAW, Kentucky Air National Guard, Standiford Field, Louisville, Kentucky (continued)

Shop Name and Location	Hazardous Waste/ Used Hazardous Material	Estimated Quantities (Gallons/Year)	Method of Treatment/Storage/Disposal 1950 1960 1970 1980 1988
Aerospace Ground Equipment Maintenance (AGE) Bldg. No. 00017	Engine Oil	300	'--UNKNOWN--------'----CONTR----'--DRMO--'
	Hydraulic Oil	300	'--UNKNOWN--------'----CONTR----'--DRMO--'
	Paint Strippers/Thinners	25	'--UNKNOWN--------'----TRASH----'--DRMO--'
	JP-4	300	'--UNKNOWN--------'-----FTA-----'---REC--'
	PD-680	55	'--UNKNOWN--------'----CONTR----'---NLU--'
	PD-140	55	'---------------NIU------------'--DRMO--'
	Turbine Oil	55	'--UNKNOWN--------'----CONTR----'--DRMO--'
	Gasoline	50	'--UNKNOWN--------'-----FTA-----'---REC--'
	Battery Acid	50	'--UNKNOWN--------'--NEUTR SAN--'--DRMO--'
	Aircraft Cleaning Materials	100	'--UNKNOWN--------'--------NEUTR SAN-----'
	7808 Oil	50	'--UNKNOWN--------'----CONTR----'--DRMO--'
Fuels and Corrosion Control Facility Bldg. No. 00025	PD-140	30	'---------------NIU------------'--DRMO--'
	PD-680	30	'--UNKNOWN--------'----CONTR----'---NLU--'
	JP-4	100	'---------------FTA------------'--DRMO--'

KEY:

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DRMO	- Disposed of through the Defense Reutilization & Marketing Office.
FTA	- Disposed of at the fire training area.
NEUTR SAN	- Disposed of through the sanitary sewer, after neutralization.
NIE	- Shop not in existence.
NIU	- Not in use.
NLU	- No longer used.
OWS	- Disposed of through an oil water separator.
SAN	- Disposed of in the sanitary sewer.
STORM	- Disposed of through the storm sewer.
TRASH	- Disposed of in general refuse.
UNKNOWN	- Information not supplied nor available.

Table 1. Hazardous Material/Hazardous Waste Disposal Summary: 123rd TAW, Kentucky Air National Guard, Standiford Field, Louisville, Kentucky (continued)

Shop Name and Location	Hazardous Waste/ Used Hazardous Material	Estimated Quantities (Gallons/Year)	Method of Treatment/Storage/Disposal 1950 1960 1970 1980 1988
Egress Bldg. No. 00010	PD-140	10	'-----------------NIU-----------'--DRMO--'
	PD-680	10	'-----------------FTA-----------'---NLU--'
	Trichloroethane	12	'-----------------FTA-----------'---NLU--'
	Strippers (MEK, MIBK)	5	'--UNKNOWN---------'-----FTA----'--DRMO--'
Pneudraulics Shop Bldg. No. 00010	PD-680	25	'--UNKNOWN---------'----CONTR---'---NLU--'
	Trichlorethane	2	'--UNKNOWN---------'----CONTR---'--DRMO--'
	Strippers (MEK, MIBK)	1	'--UNKNOWN---------'----CONTR---'---NLU--'
	Synthetic Turbine Oil	2	'--UNKNOWN---------'----CONTR---'--DRMO--'
	Hydraulic Oil	36	'--UNKNOWN---------'----CONTR---'--DRMO--'
Non-Powered AGE Bldg. No. 00021	PD-140	60	'-----------------NIE-----------'--DRMO--'
	Cleaning Compound (B&B 2020)	15	'-----------------NIE-----------'--DRMO--'
	Paint Stripper	165	'-----------------NIE-----------'--DRMO--'

KEY:

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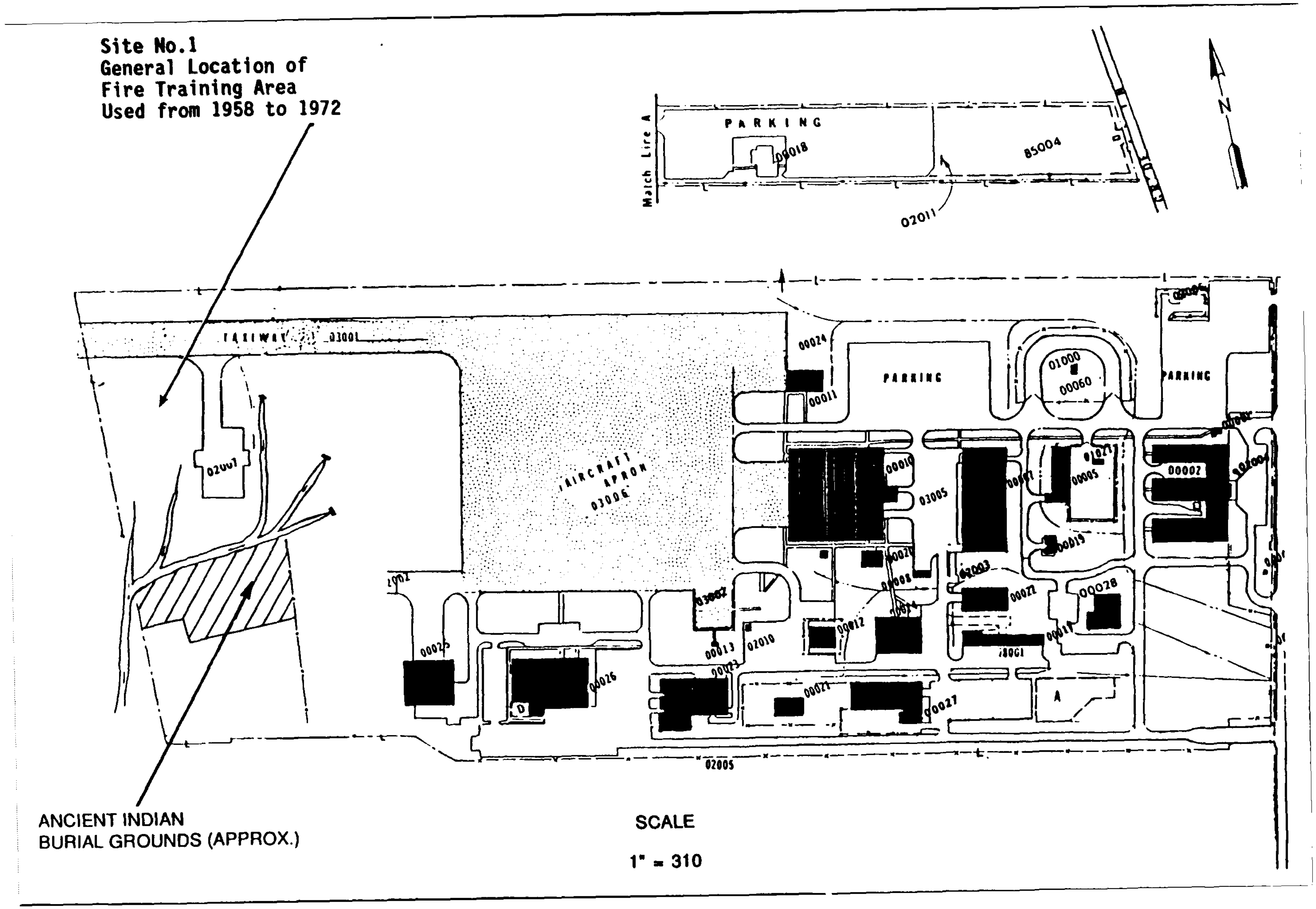
DRMO - Disposed of through the Defense Reutilization & Marketing Office.
FTA - Disposed of at the fire training area.
NEUTR SAN - Disposed of through the sanitary sewer, after neutralization.
NIE - Shop not in existence.
NIU - Not in use.
NLU - No longer used.
OWS - Disposed of through an oil water separator.
SAN - Disposed of in the sanitary sewer.
STORM - Disposed of through the storm sewer.
TRASH - Disposed of in general refuse.
UNKNOWN - Information not supplied nor available.



Site No.1
General Location of
Fire Training Area
Used from 1958 to 1972
PARKING
00018
B5004
02011
Match Line A
N
TAXIWAY
03001
00024
00011
PARKING
01000
00060
PARKING
00002
02001
00010
03005
00005
00019
00028
AIRCRAFT
APRON
03006
02003
00012
00013
02010
00025
00026
00021
00027
A
02005
ANCIENT INDIAN
BURIAL GROUNDS (APPROX.)
SCALE
1" = 310

flooding). A description of the potential site identified at the Base follows:

Site No. 1 - Fire Training Area (FTA) [HAS-58]

From 1958 to 1972, the Base conducted fire training activities where the Engine Test Stand is now located (Figure 4). This unbermed area was used three to six times per year. Training procedures included pouring 300 to 500 gallons of collected wastes directly on the ground without prior water saturation. Assuming that 70-percent of the fuel burned and a total of six burns per year for 14 years, each burn using a maximum of 500 gallons of wastes, there is a potential for 12,600 gallons of residual wastes at this site.

JP-4 and gasoline were the primary fuels used during training. Other wastes such as solvents, strippers containing MEK and MIBK, and trichloroethane were also burned. Waste oil, thinners, and carbon cleaner may have been burned at this site. The relative amounts of the various wastes that were used are unknown. For scoring purposes, only JP-4 is considered because of its high hazard based on ignitability (flash point less than 80°F) and its high toxicity (Sax's Level 3).

Aerial photographs and maps indicate that the pad for the Engine Test Stand was constructed over part of the fire training pit. The stand's foundation was placed on 1-3 feet of fill. There is no documented removal of soil from this area.

A field examination of this site revealed no visible evidence of contamination such as soil discoloration or stressed vegetation.

C. Other Pertinent Information

The Kentucky Air National Guard relocated to Standiford Field in 1958. Prior to this relocation, the present property was classified as wetlands.

The Base is serviced by the Metropolitan Sewer District and the Louisville Water Department.

Since the Base was activated in 1958, waste oils, fuels, and solvents have been collected and disposed of either through private contractors, fire training exercises, or the DRMO located at Fort Knox, Kentucky.

The Base has 15 underground storage tanks (UST) and has submitted the Notification for Underground Storage Tanks to the Commonwealth's Natural Resources Cabinet, Division of Waste Management. Appendix E contains the inventory. The Base is initiating a UST monitoring program.

The Base has five oil/water separators. They are located at the Engine Test Stand, Fuel Cell Maintenance, POL Storage, the Motor Pool, and the Wash Rack. All are connected to the sanitary sewer except for the one at the Engine Test Stand. This one drains directly into a ditch that connects with Duck Spring Branch.

Occasional spills of JP-4 involving 500 gallons or less have been reported for the POL area. The Metropolitan Sewer District and local EPA authorities were notified of these spills. Most of the released fuel was recovered and placed in containers. Any residual fuel was absorbed, placed in containers, and turned in to the Defense Reutilization and Marketing Office (DRMO). However, water mixed with residual hydrocarbons has reportedly seeped into the valve pits in the POL area.

From 1973 to 1981, fire training activities were conducted on Airport Authority property at the southern end of Runway 01/19. The Base used this Airport Authority-controlled area three to six times per year and was not the sole user. Two hundred and fifty to 500 gallons of fuel were used per exercise. After its last use, the runway was extended over it. Since 1981, all fire training activities have been conducted at Savannah, Georgia.

PCB items on the Base have been tested and removed. The last two transformers were replaced in 1984, and light ballasts suspected of containing PCBs were also replaced.

Prior to 1986, acid from spent lead-acid batteries was neutralized with sodium bicarbonate. Neutralization involved draining the acid into neutralization pits that discharged into the sanitary sewer. The Metropolitan Sewer District, concerned about lead contamination,

requested that this procedure cease. The dry battery cases were turned in to DRMO. Lead-acid batteries are currently turned in to DRMO "wet."

The Metropolitan Sewer District has established a sampling station south of United Parcel Service (UPS) property at Northern Ditch. No environmental incidents affecting surface water have been reported as resulting from Base operations. Analyses of water samples taken by Jefferson County Family and Neighborhood Services show that the public water supply passes the bacteriological test prescribed for potability in the National Primary Drinking Water Standards promulgated by the U.S. Environmental Protection Agency.

A prehistoric American Indian burial area is located (Figure 4) in the western portion of the Base.

V. CONCLUSIONS

Information obtained through interviews with 26 past and present Base personnel, a review of Base records, and field observations has resulted in the identification of one potentially contaminated disposal site on Base property. This is Site No. 1 - Fire Training Area (FTA) [HAS-58].

This site is potentially contaminated with HM/HW and exhibits the potential for contaminant migration to groundwater and surface water. Therefore, this site was assigned a HAS according to HARM.

VI. RECOMMENDATIONS

Further IRP investigations are recommended for Site No. 1 - Fire Training Area (FTA) [HAS-58].

GLOSSARY OF TERMS

ACID [chem] - A compound containing hydrogen in which all or part of the hydrogen may be exchanged for a metal or a basic radical, forming a salt.

ALKALI [chem] - A hydroxide of any of the alkali metals or ammonium radical, characterized by great solubility in water and capable of neutralizing acids.

ALLUVIUM - A general term for clay, silt, sand, gravel, or similar unconsolidated material deposited during comparatively recent geologic time by a stream or running water.

ANNUAL PRECIPITATION - The total amount of rainfall and snowfall for the year.

AQUIFER - A geologic formation, or group of formations, that contains sufficient saturated permeable material to conduct groundwater and to yield economically significant quantities of groundwater to wells and springs.

BASAL [adj] - Pertaining to, situated at, or forming the base; bottom.

BEDROCK - A general term for the rock, usually solid, that underlies soil or other unconsolidated, superficial material.

BERM [eng] - A relatively narrow man-made shelf or bench built along an embankment situated partway up and breaking the continuity of a slope.

BLOCK [part size] - A rock or mineral particle in the soil, having a diameter range of 200 to 2000 mm.

BROOK - A small stream or rivulet, commonly swiftly flowing in rugged terrain, of lesser length and volume than a creek.

CALCAREOUS - Said of a substance that contains calcium carbonate.

CHERT - A hard, extremely dense or compact, microcrystalline, siliceous rock.

CHLORIDE - A compound of chlorine with a more positive element or radical.

CLAY [soil] - A rock or mineral particle in the soil having a diameter less than 0.002 mm (2 microns).

CLAY [geol] - A rock or mineral fragment or a detrital particle of any composition smaller than a fine silt grain, having a diameter less than 1/256 mm (4 microns).

COBBLES [part size] - A rock fragment larger than a pebble and smaller than a boulder, having a diameter in the range of 64 to 256 mm (2.5 to 10 in.) being somewhat rounded or otherwise modified by abrasion in the course of transport.

COLLUVIUM - (a) A general term applied to any loose, heterogeneous, and incoherent mass of soil material and/or rock fragments deposited by rainwash, sheetwash, or slow continuous downslope creep, usually collecting at the base of gentle slopes or hillsides; (b) Alluvium deposited by unconcentrated surface runoff or sheet erosion, usually at the base of a slope.

CONCRETION - A hard, compact mass or aggregate of mineral matter, normally subspherical but commonly oblate, disk-shaped, or irregular with odd or fantastic outlines; formed by precipitation from aqueous solution about a nucleus or center, in pores of sedimentary or fragmental volcanic rock, and usually of a composition widely different from that rock in which it is found and from which it is rather sharply separated.

CONTAMINANT - As defined by Section 101(f)(33) of Superfund Amendments and Reauthorization Act of 1986 (SARA) shall include, but not be limited to any element, substance, compound, or mixture, including disease-causing agents, which after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction), or physical deformation in such organisms or their offspring, except that the term "contaminant" shall not include petroleum, including

crude oil or any fraction thereof, which is not otherwise specifically listed or designated as a hazardous substance under:

(a) any substance designated pursuant to Section 311(b)(2)(A) of the Federal Water Pollution Control Act,

(b) any element, compound, mixture, solution, or substance designated pursuant to Section 102 of this Act,

(c) any hazardous waste having the characteristics identified under or listed pursuant to Section 3001 of the Solid Waste Disposal Act (but not including any waste the regulation of which under the Solid Waste Disposal Act has been suspended by Act of Congress),

(d) any toxic pollutant listed under Section 307(a) of the Federal Water Pollution Control Act,

(e) any hazardous air pollutant listed under Section 112 of the Clean Air Act, and

(f) any imminently hazardous chemical substance or mixture with respect to which the administrator has taken action pursuant to Section 7 of the Toxic Substance Control Act:

and shall not include natural gas, liquefied natural gas, or synthetic gas of pipeline quality (or mixtures of natural gas and such synthetic gas).

CREEK - A term generally applied to any natural stream of water, normally larger than a brook but smaller than a river.

CRITICAL HABITAT - The specific areas within the geographical area occupied by the species on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management consideration or protection.

CRYSTALLINE - Pertaining to or having the nature of a crystal, or formed by crystallization; specifically having a crystal structure or angular arrangement of atoms in a space lattice.

DEPOSITS - Earth material of any type, either consolidated or unconsolidated, that has accumulated by some natural process or agent.

DEVONIAN - A period of the Paleozoic era (after the Silurian and before the Mississippian), thought to have covered the span of time between 400 and 345 million years ago.

DISCHARGE - The release of any waste stream or any constituent thereof to the environment.

DOLOMITE - A carbonate sedimentary rock of which more than 50 percent by weight or by a real percentage under the microscope consists of the mineral dolomite, or a variety of limestone or marble rich in magnesium carbonate.

DOWNGRADIENT - A direction that is hydraulically downslope.

EFFLUENT - An outflow, as of water from a lake, industrial sewage, etc.

EGRESS - The shop responsible for maintenance of the ejection seat systems on fighter aircraft.

ENDANGERED SPECIES - Any species which is in danger of extinction throughout all or a significant portion of its range, other than a species of the Class Insecta determined by the Secretary to constitute a pest whose protection would present an overwhelming and overriding risk to man.

EOLIAN - Pertaining to the wind, especially said of such deposits as loess and sand dunes, of sedimentary structures such as wind-formed ripple marks, or of erosion and deposition accomplished by the wind.

EROSION - The general process or the group of processes whereby the materials of the Earth's crust are loosened, dissolved, or worn away, and simultaneously moved from one place to another by natural agencies, but usually exclude mass wasting.

ETHYLENE GLYCOL - A colorless, sweetish alcohol $C_2H_4(OH)_2$, formed by decomposing certain ethylene compounds and used as an antifreeze mixture, lubricant, etc.

FLOOD PLAIN - The surface or strip of relatively smooth land adjacent to a river channel, constructed by the present river in its existing regimen and covered with water when the river overflows its banks.

FLUVIAL - Of or pertaining to a river or rivers, or produced by the action of a stream or river.

FORMATION - A lithologically distinctive, mappable body of rock.

FRAGIPAN - A dense subsurface layer of soil whose hardness and relatively slow permeability to water are chiefly due to extreme compactness rather than to high clay content (as in clay pan) or cementation (as in hard pan).

GLACIAL - Of or relating to the presence and activities of ice or glaciers.

GLAUCONITE - A dull-green earthy or granular mineral of the mica group: $(K, Na) (Al, Fe^{+3}, Mg)_2 (Al, Si)_4 O_{10} (OH)_2$.

GNEISS - A coarse-grained, foliated rock produced by regional metamorphism; commonly feldspar- and quartz-rich.

GRADIENT [geomorph] - A degree of inclination, or rate of ascent or descent, of an inclined part of the Earth's surface with respect to the horizontal.

GRADIENT [hydraul] - See hydraulic gradient.

GRANITE - Broadly applied, any crystalline, quartz-bearing plutonic rock; also commonly contains feldspar, mica, hornblende, or pyroxene.

GRANULE - A rock fragment larger than a very coarse sand grain and smaller than a pebble, having a diameter in the range of 2 to 4 mm (1/12 to 1/6 in.) being somewhat rounded or otherwise modified by abrasion in the course of transport.

GRAVEL - An unconsolidated, natural accumulation of rounded rock fragments resulting from erosion, consisting predominantly of particles larger than sand, such as boulders, cobbles, pebbles, granules or any combination of these fragments.

GROUNDWATER - Refers to the subsurface water that occurs beneath the water table in soils and geologic formations that are fully saturated.

HARD [water] - Property of water causing formation of an insoluble residue when the water is used with soap, and forming a scale in vessels in which water has been allowed to evaporate. It is primarily due to the presence of ions of calcium and magnesium.

HARM - Hazard Assessment Rating Methodology - A system adopted and used by the United States Air Force to develop and maintain a priority listing of potentially contaminated sites on installations and facilities for remedial action based on potential hazard to public health and welfare and on environmental impacts. (Reference: DEQPPM 81-5, December 11, 1981).

HAS - Hazard Assessment Score - The score developed by using the Hazardous Assessment Rating Methodology (HARM).

HAZARDOUS MATERIAL - Any substance or mixture of substances having properties capable of producing adverse effects on the health and safety of the human being. Specific regulatory definitions are also found in OSHA and DOT rules.

HAZARDOUS WASTE - A solid or liquid waste that, because of its quantity, concentration, or physical, chemical, or infectious characteristics may:

a. cause, or significantly contribute to, an increase in mortality or an increase in serious or incapacitating reversible illness, or

b. pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

HUMID - Containing vapor or water; moist; damp.

HYDRAULIC GRADIENT - The difference in head (elevation of water surface) at two points divided by the distance between these two points.

HYDROCARBON - Any organic compound, liquid, gaseous, or solid, consisting solely of carbon and hydrogen.

IGNEOUS ROCKS - Rock or mineral that has solidified from molten or partially molten material, i.e. from a magma.

INTERBEDDED - Beds lying between or alternating with others of different character; especially rock material laid down in sequence between other beds.

IRON [mineral] - A heavy, magnetic, malleable and ductile, and chemically active mineral, the native metallic element Fe.

KETONE - One of a class of organic compounds in which the carbonyl radical unites with two hydrocarbon radicals (i.e. acetone, methyl ethyl ketone).

LACUSTRINE - Produced by or formed in a lake; deposited on the bottom of a lake.

LIMESTONE - A sedimentary rock consisting primarily of calcium carbonate, primarily in the form of the mineral calcite.

LOAM - A rich, permeable soil composed of a friable mixture of relatively equal proportions of sand, silt, and clay particles, and usually containing organic matter.

LOESS - A widespread, homogeneous, commonly nonstratified, porous, friable, slightly coherent, usually highly calcareous, fine-grained blanket deposit (generally less than 30 inches thick).

METAMORPHIC ROCK - Any rock derived from pre-existing rocks by mineralogical, chemical, and/or structural changes, essentially in the solid state, in response to marked changes in temperature, pressure, shearing stress, and chemical environment, generally at depth in the Earth's crust.

MIGRATION (Contaminant) - The movement of contaminants through pathways (groundwater, surface water, soil, and air).

MINERAL - A naturally occurring inorganic element or compound having an orderly internal structure and characteristic chemical composition, crystal form, and physical properties.

MISSISSIPPIAN - A period of the Paleozoic era (after the Devonian and before the Pennsylvanian) from 345 to 200 million years ago.

MOTTLED [soil] - A soil that is irregularly marked with spots or patches of different colors, usually indicating poor aeration or seasonal wetness.

NET PRECIPITATION - Precipitation minus evaporation.

NITRATE - A mineral or compound characterized by a fundamental anionic structure of NO_3^-.

NODULE - A small, irregularly rounded knot, mass, or lump of mineral or mineral aggregate, normally having a warty or knobby surface and no internal structure, and usually exhibiting a contrasting composition from the enclosing sediment or rock matrix in which it is embedded.

ORDOVICIAN - The second earliest period of the Paleozoic era (after the Cambrian and before the Silurian).

OUTCROP - That part of a geologic formation or structure that appears at the surface of the Earth; also, bedrock that is covered only by surficial deposits such as alluvium.

OUTWASH [glac geol] - A stratified detritus (chiefly sand and gravel) removed or "washed out" from a glacier by meltwater streams and deposited in front of or beyond the end moraine or the margin of an active glacier.

OUTWASH PLAIN - A broad, gently sloping sheet of outwash deposited by meltwater streams flowing in front of or beyond a glacier, and formed by coalescing outwash fans.

OVERWASH - A mass of water representing the part of the uprush that runs over the berm crest (or other structure) and that does not flow directly back to the sea or lake. Or the flow of water in restricted areas over low parts of barriers or spits, especially during high tides or storms.

PD-680 - A cleaning solvent composed predominately of mineral spirits; Stoddard solvent.

PEBBLE - A general term for a small, roundish, especially water worn stone. A rock fragment larger than a granule and smaller than a cobble, having a diameter in the range of 4 to 64 mm (1/6 to 2.5 in.) being somewhat rounded or otherwise modified by abrasion in the course of transport.

PERMEABILITY - The capacity of a porous rock, sediment, or soil for transmitting a fluid without impairment of the structure of the medium; it is a measure of the relative ease of fluid flow under unequal pressure.

PESTICIDE - A chemical or other substance used to destroy plant and animal pests.

PHOSPHATIC - Pertaining to or containing phosphates or phosphoric acid; said especially of a sedimentary rock containing phosphate minerals.

PLASTIC [adj] - Capable of being molded; pliable.

PLEISTOCENE - The first epoch of the Quaternary period; the Pleistocene began 2 to 3 million years ago and lasted until the start of the Holocene period some 8000 years ago.

PLIOCENE - An epoch of the Tertiary period, after the Miocene and before the Pleistocene; thought to have covered the span of time between 5 and 1.8 million years ago.

PNEUDRAULICS - The shop responsible for maintenance of hydraulic and pneumatic systems on aircraft.

POND - A natural body of standing freshwater occupying a small surface depression, usually smaller than a lake and larger then a pool.

POTABLE [water] - Water that is safe and palatable for human consumption/digestion.

QUARTZ - Crystalline silica, an important rock-forming mineral: SiO_2. It is, next to feldspar, the common most mineral, occurring either in transparent hexagonal crystals (colorless, or colored by impurities) or in crystalline or cryptocrystalline masses. Quartz is the common most gangue mineral of ore deposits, forms the major proportion of most sands, and has a widespread distribution in igneous (especially granitic), metamorphic, and sedimentary rocks.

QUARTZITE [meta] - A granoblastic metamorphic rock consisting mainly of quartz and formed by recrystallization of sandstone or chert by either regional or thermal metamorphism.

QUATERNARY - The second period of the Cenozoic era, following the Tertiary: it began 3 to 2 million years ago and extends to the present.

RECENT - An epoch of the Quaternary period which covers the span of time from the end of the Pleistocene epoch, approximately 8000 years ago to the present. Also called the Holocene epoch.

RIVER - A general term for a natural freshwater surface stream of considerable volume and a permanent or seasonal flow, moving in a definite channel toward a sea, lake, or another river.

SAND - A rock or mineral particle in the soil having a diameter in the range 0.52 to 2 mm.

SATURATED [water] - Said of the condition in which the interstices of a material are filled with a liquid, usually water.

SCHIST - A medium or coarse-grained, strongly foliated, crystalline rock; formed by dynamic metamorphism.

SEDIMENT - (a) Solid fragmental material that originates from weathering of rocks and is transported or deposited by air, water, or ice, or that accumulates by other natural agents, such as chemical precipitation from solution or secretion by organisms, and that forms in layers on the Earth's surface at ordinary temperatures in a loose, unconsolidated form, (b) Strictly solid material that has settled down from a state of suspension in a liquid.

SEDIMENTARY ROCK - A rock resulting in the consolidation of loose sediment that has accumulated in layers; e.g., a clastic rock (such as conglomerate or tillite) consisting of mechanically formed fragments of older rock transported from its source and deposited in water or from air or ice; or a chemical rock (such as rock salt or gypsum) formed by precipitation from solution; or an organic rock (such as certain limestones) consisting of the remains or secretions of plants and animals.

SHALE - A fine-grained detrital sedimentary rock, formed by the consolidation (esp. by compression) of clay, silt, or mud.

SHEEN - A subdued and often irridescent or metallic glitter that approaches but is just short of optical reflection.

SILT [soil] - (a) A rock or mineral particle in the soil, having a diameter in the range 0.002 to 0.005 mm; (b) A soil containing more than 80 percent silt-size particles, less than 12 percent clay, and less than 20 percent sand.

SILT LOAM - A soil containing 50 to 88 percent silt, 0 to 27 percent clay, and 0 to 50 percent sand.

SILTSTONE - An indurated silt having the texture and composition of shale but lacking its fine lamination or fissility.

SILTY CLAY - An unconsolidated sediment containing 40 to 75 percent clay, 12.5 to 50 percent silt, and 0 to 20 percent sand; or an unconsolidated sediment containing more particles of clay size than of silt size, more than 10 percent silt, and less than 10 percent of all other coarser sizes.

SILTY CLAY LOAM - A soil containing 27 to 40 percent clay, 60 to 73 percent silt, and less than 20 percent sand.

SILURIAN - A period of the Paleozoic era, thought to have covered the span of time between 440 and 400 million years ago; also the corresponding system of rocks.

SLACK WATER - A quiet part of, or a still body of water in, a stream (e.g., on the inside of a bend, where the current is slight). Syn: slack [water].

SLOPE - (a) Gradient; (b) The inclined surface of any part of the Earth's surface.

SOLVENT - A substance, generally a liquid, capable of dissolving other substances.

STICKY POINT - A condition of consistency at which a soil material barely fails to adhere to a foreign object; specifically, the moisture content of a well-mixed, kneaded soil material that barely fails to adhere to a polished nickel or stainless-steel surface when the shearing speed is 5 cm/sec.

STONE - A general term for rock that is used for construction, either crushed for use as aggregate or cut into shaped blocks as dimension stone.

SURFACE WATER - All water exposed at the ground surface, including streams, rivers, ponds, and lakes.

TERRACE [geomorph] - Any long, narrow, relatively level or gently inclined surface, generally less broad than a plain, bounded along one edge by a steeper descending slope and along the other by a steeper ascending slope.

TERRACE [soil] - A horizontal or gently sloping ridge or embankment of earth built along the contours of a hillside for the purpose of conserving moisture, reducing erosion, or controlling runoff.

THREATENED SPECIES - Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

TOPOGRAPHY - The general conformation of a land surface, including its relief and the position of its natural and man-made features.

UPGRADIENT - A direction that is topographically or hydraulically upslope.

VALLEY - [Geomorph] Any low-lying land bordered by higher ground, especially an elongate, relatively large, gently sloping depression of the Earth's surface, commonly situated between two mountains or between ranges of hills or mountains, and often containing a stream with an outlet. It is usually developed by stream erosion but may be formed by faulting.

VARSOL - A mineral spirit; used as a solvent.

WATER TABLE - The surface between the zone of saturation and the zone of aeration; that surface of a body of unconfined groundwater at which the pressure is equal to that of the atmosphere.

WETLANDS - A general term for a group of wet habitats, in common use by specialists in wildlife management. It includes areas that are permanently wet and/or intermittently water-covered, especially coastal marshes, tidal swamps and flats, and associated pools, sloughs, and bayous.

WILDERNESS AREA - An area unaffected by anthropogenic activities and deemed worthy of special attention to maintain its natural condition.

WISCONSIN - Pertaining to the classical fourth glacial stage of the Pleistocene Epoch in North America, following the Sangamon interglacial stage and preceding the Holocene.

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Faust, R.J. Kentucky Ground-Water Resources. National Water Summary. U.S. Geological Survey Water-Supply Paper 2275, 1984.

Jefferson County Family and Neighborhood Services. Water Sample Results. Louisville and Jefferson County Board of Health, May 1988.

Kepferle, Roy C. Geologic Map of the Louisville East Quadrangle, Jefferson County, Kentucky. U.S. Geological Survey, 1974.

Kiesler, J. L., L. H. Woosley, Jr., and R. W. Davis, Kentucky Ground-Water Quality. U.S. Geological Survey Open-File Report 87-0727, 1987.

Office of the Federal Register. Part 300. National Oil and Hazardous Substances Pollution Contingency Plan, Subpart H. Federal Register. National Archives and Records Service. Washington, D.C., July 16, 1982.

Public Affairs Office. History of the 123rd Tactical Reconnaissance Wing. Kentucky Air National Guard. Standiford Field, Louisville, Kentucky, 1988.

Sax, N. Irving, Dangerous Properties of Industrial Materials, Sixth Edition. Van Nostrand Reinhold, Co., New York, NY, 1984.

Shulhafer & Associates. Weapon System Security Flight Facility. Air National Guard, Standiford Field, Louisville, Kentucky. Record of Soil Exploration, April 1983.

U.S. Army Corps of Engineers, Arra Smith & Tyler, Contours and Test Borings. Standiford Field, Air National Guard Facilities, Louisville, Kentucky, March 1957.

U.S. Department of Defense. Defense Environmental Quality Program Policy Memorandum (DEQPPM81-5), December 11, 1981.

U.S. Geological Survey. Louisville East, Kentucky, 7.5 Minute Series Quadrangle Map, 1982.

Zimmerman, W.H. Soil Survey of Jefferson County, Kentucky. U.S. Department of Agriculture, Soil Conservation Service, June 1966.

Appendix A

Resumes of Search Team Members

RAYMOND G. CLARK, JR.

EDUCATION

Completed graduate engineering courses, George Washington University, 1957
B.S., Mechanical Engineering, University of Maryland, 1949

SPECIALIZED TRAINING

Grad. European Command Military Assistance School, Stuttgart, 1969
Grad. Army Psychological Warfare School, Fort Bragg, 1963
Grad. Sanz School of Languages, D.C., 1963
Grad. DOD Military Assistance Institute, Arlington, 1963
Grad. Defense Procurement Management Course, Fort Lee, 1960
Grad. Engineer Officer's Advanced Course, Fort Belvoir, 1958

CERTIFICATIONS

Registered Professional Engineer: Kentucky (#4341); Virginia (#8303); Florida (#36228)

EXPERIENCE

Thirty-one years of experience in engineering design, planning and management including construction and construction management, environmental, operations and maintenance, repair and utilities, research and development, electrical, mechanical, master planning and city management. Over six years' logistical experience including planning and programming of military assistance materiel and training for foreign countries, serving as liaison with American private industry, and directing materiel storage activities in an overseas area. Over two years' experience as an engineering instructor. Extensive experience in personnel management, cost reduction programs, and systems improvement.

EMPLOYMENT

<u>Dynamac Corporation (1986-present)</u>: Program Manager/Department Manager

Responsible for activities relating to Preliminary Analysis, Site Investigations, Remedial Investigations, Feasibility Studies, and Remedial Action for the Installation Restoration Program for the U.S. Air Force, Air National Guard, Bureau of Prisons, and the U.S. Coast Guard, including records search, review and evaluation of previous studies; preparation of statements of work, feasibility studies; preparation of remedial action plans, designs and specifications; review of said studies/plans to ensure that they are in conformance with requirements; review of environmental studies and reports; preparation of Air Force Installation Restoration Program Management Guidance; and preparation of Part B permits.

Howard Needles Tammen & Bergendoff (HNTB) (1981-1986): Manager

Responsible, as Project Manager, for: design of a new concourse complex at Miami International Airport to include terminal building, roadway system, aircraft apron, drainage channel relocation, satellite building with underground pedestrian tunnel, and associated underground utility corridors, to include subsurface aircraft fueling systems, with an estimated construction cost of $163 million; a cargo vehicle tunnel under the crosswind runway with an estimated construction cost of $15 million; design and constructicn of two large corporate jet aircraft hangars; and for the hydrocarbon recovery program to include investigation, analysis, design of recovery systems, monitoring of recovery systems, and planning and design of residual recovery systems utilizing biodegradation. Participated, as sub-consultant, in Air Force IRP seminar.

HNTB (1979-1981): Airport Engineer

Responsibilities included development of master plan for Iowa Air National Guard base; project initiation assistance for a new regional airport in Florida; engineering assistance for new facilities design and construction for Maryland Air National Guard; master plan for city maintenance facilities, Orlando, Florida; in-country master plan and preliminary engineering project management for Madrid, Spain, International Airport; and project management of master plan for Whiting Naval Air Station and outlying fields in Florida.

HNTB (1974-1979): Design Engineer

Responsibilities included development of feasibility and site selection studies for reliever airports in Cleveland and Atlanta; site selection and facilities requirements for the Office of Aeronautical Charting and Cartography, NOAA; and onsite mechanical and electrical engineering design for terminal improvements at Baltimore-Washington International Airport, Maryland.

HNTB (1972-1974): Airport Engineer

Responsible for development of portions of the master plan and preliminary engineering for a new international airport for Lisbon, Portugal, estimated to cost $250 million.

Self-employed (1971-1972): Private Consultant

Responsible for engineering planning and installation of a production line for multimillion-dollar contract in Madrid, Spain, to fabricate transmissions and differentials for U.S. Army vehicles.

U.S. Army, Corps of Engineers (1969-1971): Chief, Materiel & Programs

Directed materiel planning and military training programs of military assistance to the Spanish Army. Controlled arrival and acceptance of materiel by host government. Served as liaison/advisor to American industry interested

in conducting business with Spanish government. Was Engineer Advisor to Spanish Army Construction, Armament and Combat Engineers, also the Engineer Academy and Engineer School of Application.

Corps of Engineers (1968-1969): Chief, R&D Branch, OCE

Directed office responsible to Chief of Engineers for research and development. Developed research studies in new concepts of bridging, new explosives, family of construction equipment, night vision equipment, expedient airfield surfacing, expedient aircraft fueling systems, water purification equipment and policies, prefabricated buildings, etc. Achieved Department of Army acceptance for development and testing of new floating bridge. Participated in high-level Department Committee charged with development of a Tactical Gap Crossing Capability Model.

Corps of Engineers (1967-1968): Division Engineer

Facilities engineer in Korea. Was fully responsible for management and maintenance of 96 compounds within 245 square miles including 6,000+ buildings, 1 million linear feet of electrical distribution lines, 18 water purification and distribution systems, sanitary sewage disposal systems, roads, bridges, and fire protection facilities with real property value of more than $256 million. Planned and developed the first five-year master plan for this area. Administered $12 million budget and $2 million engineer supply operation. Was in responsible charge of over 500 persons. Developed and obtained approval for additional projects worth $9 million for essential maintenance and repair. Directed cost reduction programs that produced more than $500,000 savings to the United States in the first year.

Corps of Engineers (1963-1967): Engineer Advisor

Engineer and aviation advisor to the Spanish Army. Developed major modernization program for Spanish Army Engineers, including programming of modern engineer and mobile maintenance equipment. Directed U.S. portion of construction, testing and acceptance of six powder plants, one shell loading facility, an Engineer School of Application, and depot rebuild facilities for engineer, artillery, and armor equipment. Planned and developed organization of a helicopter battalion for the Spanish Army. Responsible for sales, delivery, assembly and testing of 12 new helicopters in country. Provided U.S. assistance to unit until self-sufficiency was achieved. Was U.S. advisor to Engineer Academy, School of Application and Polytechnic Institute.

Corps of Engineers (1960-1963): Deputy District Engineer

Responsible for planning and development of extensive construction projects in the Ohio River Basin for flood control and canalization, including dam, lock, bridge, and building construction, highway relocation, watershed studies, real estate acquisitions and dispositions. Was contracting officer for more than $75

million of projects per year. Supervised approximately 1,300 personnel, including 300 engineers. Planned and directed cost reduction programs amounting to more than $200,000 per year. Programmed and controlled development of a modern radio and control net in a four-state area.

Corps of Engineers (1959-1960): Area Engineer

Directed construction of a large airfield in Ohio as Contracting Officer's representative. Assured that all construction (runway, steam power plant, fuel transfer and loading facilities, utilities, buildings, etc.) complied with terms of plans and specifications. Was onsite liaison between Air Force and contractors.

Corps of Engineers (1958-1959): Chief, Supply Branch

Managed engineer supply yard containing over $21 million construction supplies and engineer equipment. Directed in-storage maintenance, processing and deprocessing of equipment. Achieved complete survey of items on hand, a new locator system and complete rewarehousing, resulting in approximately $159,000 savings in the first year.

Corps of Engineers (1957-1958): Student

U.S. Army Engineer School, Engineer Officer's Advanced Course.

Corps of Engineers (1954-1957): Engineer Manager

Managed engineer construction projects and was assigned to staff and faculty of the Engineer School. Was in charge of instruction on engineer equipment utilization, management and maintenance. Directed Electronic Section of the school. Coordinated preparation of five-year master plan for the Department of Mechanical and Technical Equipment.

Corps of Engineers (1949-1954): Engineer Commander

Positions of minor but increasing importance and responsibility in engineering management, communications, demolitions, construction administration and logistics.

PROFESSIONAL AFFILIATIONS

Member, National Society of Professional Engineers
Fellow, Society of Amarican Military Engineers
Member, American Society of Civil Engineers
Member, Virginia Engineering Society
Member, Project Management Institute

HARDWARE

IBM PC

SOFTWARE

Lotus 1-2-3, D Base III Plus, Framework, Project Scheduler 5000, Harvard Project Manager, Volkswriter, Microsoft Project

BETSY A. BRIGGS

EDUCATION

B.S., Biology and Chemistry, State University College of New York at Cortland, 1979

Completed several courses in M.B.A. program, University of Phoenix, Denver, Colorado Division, 1984

SPECIALIZED TRAINING

Hazardous Waste Management course, Air Force Institute of Technology, 1986

CERTIFICATION

Certified Hazardous Materials Manager, Institute of Hazardous Materials Management, 1985

SECURITY CLEARANCE

Secret/DOE

EXPERIENCE

Nine years of experience including three years in hazardous waste management, two years as an environmental engineer, two years as an ecologist, and two years in laboratory research. Has conducted ambient air quality monitoring programs, critical pathways projects to study movement of radioactive materials in the environment, metallurgic laboratory analyses, and independent studies in biology and chemistry. Currently provides managerial oversight and technical support to a hazardous waste program for the Air Force.

EMPLOYMENT

Dynamac Corporation (1985-present): Program Manager/Hazardous Waste Specialist

Primary responsibility as program manager is to oversee and manage up to 44 field personnel involved in RCRA and CERCLA work in support of the U.S. Air Force. Other duties include performing preliminary assessments/site surveys for the Air National Guard, marketing and proposal preparation, and preparing and providing training in preparation for the Certified Hazardous Materials Manager examination.

As hazardous waste specialist the primary responsibility was to manage the hazardous waste program at Myrtle Beach Air Force Base. Duties included:

- o Reviewing the design and specifications of various base construction projects and overseeing such projects to ensure compliance with all applicable state and federal hazardous waste regulations. Projects under design included a corrosion control facility, TSD facility, two accumulation points, and a parts cleaning vat system. Construction project oversight included the final inspection of the entomology building to ensure that the facility was equipped for proper storage, usage and disposal of pesticides; removal of materials contaminated with pesticides, PCBs, petroleum products, and solvents from six sites; asbestos removal and disposal from a former hangar site; and the removal of two underground storage tanks, one of which was leaking.
- o Conducting surveys of hazardous waste generating activities.
- o Advising on need for and methods of minimizing hazardous waste generation.
- o Writing and maintaining hazardous waste management plan.
- o Preparing hazardous waste management reports and documents required by state and federal law.
- o Maintaining liaison with federal and state regulatory agencies on matters involving criteria, standards, performance specifications, and monitoring.
- o Providing information and technical consultation to Air Force installation staff regarding hazardous materials and hazardous waste operations.
- o Serving as ad hoc advisor to environmental contingency response teams.

<u>Rockwell International (1982-1984)</u>: Environmental Engineer

Primary responsibility was collection, evaluation, and reporting of ambient air monitoring data. Other responsibilities included technical assistance for monitoring total suspended solids in ambient air. Also performed data collection and reduction of air effluent emission control activities.

Environmental monitoring and control programs are to ensure that all Department of Energy and other governmental effluent regulations are met, and that plant effluents are consistent with the As Low As Reasonably Achievable (ALARA) Principle. Monthly and Annual Reports summarize the effluent and environmental monitoring programs.

<u>Rockwell International (1980-1982)</u>: Ecologist

Responsible for planning, organizing, and leading critical pathways projects designed to study the movement of radioactive materials throughout the environment. Projects were: (1) general critical pathway evaluation to identify

sampling points possibly not considered in present monitoring program; (2) plant uptake versus plant uptake plus foliar deposition measurement study; (3) deer tissue analysis program; and (4) food stuff monitoring program. Progress and results were published in semiannual reports.

Colorado School of Mines Research Institute, Texas Gulf Research Laboratory (1979-1980): Senior Laboratory Technician

Work involved quantitative analysis of platinum, palladium, and silver in soil samples. Analysis included sample preparation, fire assays, calorimetric procedures, and smelt tests.

State University College of New York at Cortland (1978-1979): Undergraduate Independent Study

Project involved the isolation of trail pheromone from spun silk of *Hyphantria* (fall webworm). Included organic and inorganic extraction procedures and performing bioassays. Also worked on production of synthetic diet comparable to fresh leaf diet for *Malacosomo* (eastern tent caterpillar).

PUBLICATIONS

Hazardous Waste Management Survey for Myrtle Beach Air Force Base, Hazardous Materials Technical Center, Rockville, Maryland, 1986 and 1988.

Hazardous Waste Management Plan for Myrtle Beach Air Force Base, Hazardous Materials Technical Center, Rockville, Maryland, 1987 and 1988.

Waste Minimization Guidance for Myrtle Beach Air Force Base, Hazardous Materials Technical Center, Rockville, Maryland, 1988.

Underground Storage Tank Management Plan for Myrtle Beach Air Force Base, Hazardous Materials Technical Center, Rockville, Maryland, 1988.

Annual Environmental Monitoring Report, Rockwell International, Energy Systems Group, Rocky Flats Plant, 1982 and 1983.

Environmental Studies Group Semiannual Report, Rockwell International, Energy Systems Group, Rocky Flats Plant, June/December of 1980 and 1981.

TECHNICAL PRESENTATIONS

PCB Management, Myrtle Beach Air Force Base, 1987.

Underground Storage Tank Regulations/History, Myrtle Beach Air Force Base, 1986.

Overview of the Hazardous Waste Training Program, Myrtle Beach Air Force Base, 1985.

Overview of the Environmental Studies Group, Nevada Test Site and Rockwell International at Hanford, Washington, 1981.

MARK D. JOHNSON

EDUCATION

B.S., Geology, James Madison University, 1980

EXPERIENCE

Eight years' technical and management experience including geologic mapping, subsurface investigations, foundation inspections, groundwater monitoring, pumping and observation well installation, geotechnical instrumentation, groundwater assessment, preparation of Air Force Installation Restoration Program Guidance, preparation of statements of work for environmental field monitoring and feasibility studies for the Air Force and the Air National Guard, development of environmental field monitoring programs, and preparation of Preliminary Assessments for the Air National Guard.

EMPLOYMENT

Dynamac Corporation (1984-present): Senior Staff Scientist/Geologist

Primarily responsible for developing and managing technical support programs relevant to CERCLA related activities for the Air Force, Air National Guard, Department of Justice and Coast Guard. These activities include Statements of Work for Site Investigations (SI), Remedial Investigations (RI), and Feasibility Studies (FS); assessing groundwater at hazardous waste disposal/spill sites for the purpose of determining rates and extents of contaminant migration and for developing SI and RI programs and identifying remedial actions; reviewing SI, RI and FS contractor work plans for various government clients, developing technical and contractual requirements for SI, RI and FS projects, managing the development and preparation of Preliminary Assessments, and assisting clients in the development of their environmental management programs, which included preparation of the Air Force's Installation Restoration Program Management Guidance document.

Bechtel Associates Professional Corporation (1981-1984): Geologist

Performed the following duties in conjunction with major civil engineering projects including subways, nuclear power plants and buildings: prepared geologic maps of surface and subsurface facilities in rock and soil including tunnels, foundations and vaults; assessed groundwater conditions in connection with construction activities and groundwater control systems; monitored the installation of permanent and temporary dewatering systems and observation wells; monitored surface and subsurface settlement of tunnels; and participated in subsurface investigations.

Schnabel Engineering Associates (1981): Geologist

Inspected foundations and backfill placement.

PROFESSIONAL CREDENTIALS

Registered Professional Geologist, South Carolina, #116, 1987

PROFESSIONAL AFFILIATIONS

Association of Engineering Geologists
National Water Well Association/Association of Ground Water Scientists and Engineers

NATASHA M. BROCK

EDUCATION

Graduate work, civil/environmental engineering, University of Maryland, 1987-present
Graduate work, civil/environmental engineering, University of Delaware, 1985-1986
B.S. (cum laude), environmental science, University of the District of Columbia, 1984
Undergraduate work, biology, The American University, 1978-1980

CERTIFICATION

Health & Safety Training Level C

EXPERIENCE

Three years' experience in the environmental and hazardous waste field. Work performed includes remedial investigations/feasibility studies, RCRA facility assessments, comprehensive monitoring evaluations, and remedial facility investigations. Helped develop and test biological and chemical processes used in minimization of hazardous and sanitary waste generation. Researched multiple substrate degradation using aerobic and anaerobic organisms.

EMPLOYMENT

Dynamac Corporation (1987-present): Environmental Scientist

In working for Dynamac's Hazardous Materials Technical Center (HMTC), performs Preliminary Assessments, Remedial Investigations and Feasibility Studies (PA/RI/FS) under the Air National Guard Installation Restoration Program. Specifically involved in determining rates and extent of contamination, recommending groundwater monitoring procedures, and soil sampling and analysis procedures. In the process of preparing standard operating procedure manuals for quick remedial response to site spills and releases, and PA/RI/FS.

C.C. Johnson & Malhotra, P.C. (1986-1987): Environmental Scientist

Involved as part of a team in performing Remedial Investigations/Feasibility Studies (RI/FS) for EPA Regions I and IV under Resource Conservation and Recovery Act (RCRA) work assignments for REM II projects. Participated on a team involved in RCRA Facility Assessments (RFAs), Comprehensive Monitoring Evaluations (CMEs), and Remedial Facility Investigations (RFIs) for EPA work assignments under RCRA for REM III projects in Regions I and IV. Work included solo oversight observations of field sampling and facility inspections. Additional responsibilities included promotion work, graphic layout, data entry-quality check for various projects. Certified Health & Safety Training Level C.

Work Force Temporary Services (1985-1986): Research Scientist

In working for DuPont's Engineering Test Center, helped in the development and testing of laboratory-scale biological and chemical processes for a division whose main purpose was to reduce the amount of hazardous waste generated. Also worked for Hercules, Inc., with a group involved in polymer use for wastewater treatment for clients in various industrial fields. Specifically involved in product consultation, troubleshooting, and product development.

National Oceanic and Atmospheric Administration (1982-1984): Research Assistant

Involved with an information gathering and distribution center of weather impacts worldwide. Specifically involved in data collection, distribution of data to clients, assessment production and special reports.

JANET SALYER EMRY

EDUCATION

M.S., Geology, Old Dominion University, 1987
B.S. (cum laude), Geology, James Madison University, 1983

EXPERIENCE

Three years of technical experience in the fields of hydrogeology and environmental science, including drilling and placement of wells, well monitoring, aquifer testing, determination of hydraulic properties, computer modeling of aquifer systems, and field and laboratory soils analysis. Experienced in addressing technical and public audiences concerning hazardous waste site risks and proposed remedial actions.

EMPLOYMENT

Dynamac Corporation (1987-present): Staff Scientist/Hydrogeologist

Responsibilities include technical and public forum support for Preliminary Assessments, Site Investigations, Remedial Investigations, Feasibility Studies, and Emergency Responses to include providing geological and hydrological assessments of hazardous waste disposal/spill sites, determination of rates and extents of contaminant migration, and computer modeling of groundwater flow and contaminant transport. Assists site personnel in the communication of risk evaluations to the surrounding community.

Froehling and Robertson, Inc. (1986-1987): Geologist/Engineering Technician

Performed both field and laboratory engineering soils tests.

The Nature Conservancy (1985-1986): Hydrogeologist

Investigated groundwater geology of the Nature Conservancy's Nags Head Woods Ecological Preserve in Dare County, North Carolina. Study included installing wells, monitoring water table levels, determination of hydraulic parameters through a pumping test, stratigraphic test borings, and computer modeling.

Old Dominion University (1983-1985): Teaching Assistant, Department of Geological Sciences

Taught laboratory classes in Earth Science and Historical Geology.

PROFESSIONAL AFFILIATIONS

Geological Society of America
National Water Well Association/Association of Ground Water Scientists and Engineers

PUBLICATION

Impact of Municipal Pumpage Upon a Barrier Island Water Table, Nags Head and Kill Devil Hills, North Carolina. In: Abstracts with Programs, Geological Society of America, Vol. 19, No. 2, February 1987.

Appendix B

Outside Agency

Contact List

OUTSIDE AGENCY CONTACT LIST

1. Commonwealth of Kentucky
   Department of Fish and Wildlife Resources
   Arnold L. Mitchell Bldg.
   #1 Game Farm Rd.
   Frankfort, KY 40601
   Phone (502) 564-3400

2. Frankfort Division of Water
   18 Reilly Rd.
   Frankfort, KY 40601
   Phone (502) 564-3410

3. Jefferson County Office of Historic Preservation and Archives
   Suite 204, Louisville Gardens
   525 W. Muhammad Ali Blvd.
   Louisville, KY 40202
   Phone (502) 625-5761

4. Kentucky Geological Survey
   228 Mining and Mineral Resources Bldg.
   Lexington, KY 40506-0107
   Phone (606) 257-5500

5. Kentucky Heritage Council
   State Historical Preservation Office
   12th Floor, Capital Plaza Towers
   Frankfort, KY 40601
   Phone (502) 564-7005

6. Louisville District Corps of Engineers
   P. O. Box 59
   Louisville, KY 40201
   Phone (502) 582-6015

7. Louisville and Jefferson County Planning Commission
   531 Court Place, Rm. 900
   Louisville, KY 40202
   Phone (502) 625-6230

8. Louisville Water Department
   435 South Third Street
   Louisville, KY 40202
   Phone (502) 569-3600

9. Natural Resources & Environmental Protection Cabinet
Division of Waste Management
400 Sherburn Lane, Suite 301
Louisville, KY 40207
Phone (502) 588-4254

10. Public Works and Transportation Department
401 Fiscal Court Bldg.
Louisville, KY 40202
Phone (502) 625-5810

11. Regional Airport Authority
1 Standiford Field
Louisville, KY 40209
Phone (502) 368-6524

12. United Parcel Service
Standiford Field
Louisville, KY
Phone (502) 363-7127

13. U.S. Department of Agriculture
Soil Conservation Service
Louisville, KY 40218
Phone (502) 499-1900

14. U.S. Geological Survey
2301 Bradley Ave.
Louisville, KY 40217
Phone (502) 582-5241

15. U.S. Geological Survey Library
12201 Sunrise Valley Drive
Reston, VA
Phone (703) 648-4000

Appendix C

USAF Hazard Assessment Rating Methodology

USAF HAZARD ASSESSMENT RATING METHODOLOGY

The Department of Defense (DoD) has developed a comprehensive program to identify, evaluate, and control hazardous waste disposal practices associated with past waste disposal techniques at DoD facilities. One of the actions required under this program is to:

> Develop and maintain a priority listing of contaminated installations and facilities for remedial action based on potential hazard to public health, welfare, and environmental impacts (Reference: DEQPPM 81-5, December 11, 1981).

Accordingly, the U.S. Air Force has sought to establish a system to set priorities for taking further action at sites based upon information gathered during the Preliminary Assessment phase of the Installation Restoration Program.

PURPOSE

The purpose of the site rating model is to assign a ranking to each site where there is suspected contamination from hazardous substances. This model will assist the National Guard in setting priorities for follow-up site investigations.

This rating system is used only after it has been determined that (1) potential for contamination exists (hazardous waste present in sufficient quantity), and (2) potential for migration exists. A site may be deleted from ranking consideration on either basis.

DESCRIPTION OF THE MODEL

Like the other hazardous waste site ranking models, the U.S. Air Force's site rating model uses a scoring system to rank sites for priority attention. However, in developing this model, the designers incorporated some special features to meet specific DoD needs.

The model uses data readily obtained during the Preliminary Assessment portion of the IRP. Scoring judgment and computations are easily made. In assessing the hazards at a given site, the model develops a score

based on the most likely routes of contamination and worst hazards at the site. Sites are given low scores only if there are clearly no hazards. This approach meshes well with the policy for evaluating and setting restrictions on excess DoD properties.

Site scores are developed using the appropriate ranking factors presented in this appendix. The site rating form and the rating factor guidelines are provided at the end of this appendix.

As with the previous model, this model considers four aspects of the hazard posed by a specific site: (1) possible receptors of the contamination, (2) the waste and its characteristics, (3) the potential pathways for contaminant migration, and (4) any effort that was made to contain the waste resulting from a spill.

The receptors category rating is based on four rating factors: (1) the potential for human exposure to the site, (2) the potential for human ingestion of contaminants should underlying aquifers be polluted, (3) the current and anticipated use of the surrounding area, and (4) the potential for adverse effects upon important biological resources and fragile natural settings. The potential for human exposure is evaluated on the basis of the total population within 1000 feet of the site and the distance between the site and the base boundary. The potential for human ingestion of contaminants is based on the distance between the site and the nearest well, the groundwater use of the uppermost aquifer, and population served by the groundwater supply within 3 miles of the site. The uses of the surrounding area are determined by the zoning within a 1-mile radius. Determination of whether or not critical environments exist within a 1-mile radius of the site predicts the potential for adverse effects from the site upon important biological resources and fragile natural settings. Each rating factor is numerically evaluated (0-3) and increased by a multiplier. The maximum possible score is also computed. The factor score and maximum possible scores are totaled, and the receptors subscore is computed as follows: receptors subscore = (100 X factor subtotal/maximum score subtotal).

The waste characteristics category is scored in three steps. First, a point rating is assigned based on an assessment of the waste quantity and the hazard (worst case) associated with the site. The level of confidence

in the information is also factored into the assessment. Next, the score is multiplied by a waste persistence factor, which acts to reduce the score if the waste is not very persistent. Finally, the score is further modified by the physical state of the waste. Liquid wastes receive the maximum score while scores for solids are reduced.

The pathways category rating is based on evidence of contaminant migration along one of three pathways: surface water migration, flooding, and groundwater migration. If evidence of contaminant migration exists, the category is given a subscore of 80 to 100 points. For indirect evidence, 80 points are assigned, and for direct evidence, 100 points are assigned. If no evidence is found, the highest score among the three possible routes is used. The three pathways are evaluated, and the highest score among all four of the potential scores is used.

The scores for each of the three categories are added together and normalized to a maximum possible score of 100. The waste management practice category is then scored. Scores for sites with no containment are not reduced. Scores for sites with limited containment can be reduced by 5 percent. If a site is contained and well-managed, its score can be reduced by 90 percent. The final site score is calculated by applying the waste management practices category factor to the sum of the score for the other three categories.

HAZARDOUS ASSESSMENT RATING FORM

: OF SITE

.TION ______

: OF OPERATION OR OCCURRENCE ______

'R/OPERATOR ______

IENTS/DESCRIPTION ______

RATED BY ______

ECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Population within 1,000 ft. of site		4		12
Distance to nearest well		10		30
Land use-zoning within 1 mile radius		3		9
Distance to installation boundary		6		18
Critical environments within 1 mile radius of site		10		30
Water quality of nearest surface water body		6		18
Groundwater use of uppermost aquifer		9		27
Population served by surface water supply within 3 miles downstream of site		6		18
Population served by groundwater supply within 3 miles of site		6		18
		Subtotals	______	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal)

WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) ______

2. Confidence level (C = confirmed, S = suspected) ______

3. Hazard rating (H = high, M = medium, L = low) ______

Factor Subscore A (from 20 to 100 based on factor score matrix)

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B
______ x ______ = ______

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

______ x ______ =

PATHWAYS ıting Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore

Rate the migration potential for 3 potential pathways: Surface water migration, flooding, and groundwater migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water		8		24
Net precipitation		6		18
Surface erosion		8		24
Surface permeability		6		18
Rainfall intensity		8		24
Subtotals			________	108

Subscore (100 x factor score subtotal/maximum score subtotal)

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding		1		3

Subscore (100 x factor score/3) 0

3. Groundwater migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to groundwater		8		24
Net precipitation		6		18
Soil permeability		8		24
Subsurface flows		8		24
Direct access to groundwater		8		24
Subtotals			________	114

Subscore (100 x factor score subtotal/maximum score subtotal)

Highest pathway score
Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore ________

STE MANAGEMENT PRACTICES

Average the three subscores for receptors, waste characteristics, and pathways.

Receptors
Waste Characteristics
Pathways

Total ______ divided by 3 = ________
Gross Total Score

Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

______ x ________ = [ ]

HAZARDOUS ASSESSMENT RATING METHODOLOGY GUIDELINES

I. RECEPTORS CATEGORY

	Rating Factors	Rating Scale Levels: 0	1	2	3	Multiplier
A.	Population within 1,000 feet (includes on-base facilities)	0	1-25	26-100	Greater than 100	4
B.	Distance to nearest water well	Greater than 3 miles	1 to 3 miles	3,001 feet to 1 mile	0 to 3,000 feet	10
C.	Land use/zoning (within 1-mile radius)	Completely remote (zoning not applicable)	Agricultural	Commercial or industrial	Residential	3
D.	Distance to installation boundary	Greater than 2 miles	1 to 2 miles	1,001 feet to 1 mile	0 to 1,000 feet	6
E.	Critical environments (within 1-mile radius)	Not a critical environment	Natural areas	Pristine natural areas; minor wetlands; preserved areas; presence of economically important natural resources susceptible to contamination	Major habitat of an endangered or threatened species; presence of recharge area; major wetlands	10
F.	Water quality/use designation of nearest surface water body	Agricultural or industrial use	Recreation, propagation and management of fish and wildlife	Shellfish propagation and harvesting	Potable water supplies	6
G.	Groundwater use of uppermost aquifer	Not used, other sources readily available	Commercial industrial, or irrigation, very limited other water sources	Drinking water, municipal water available	Drinking water, no municipal water available, commercial, industrial, or irrigation; no other water source available	9
H.	Population served by surface water supplies within 3 miles downstream of site	0	1-50	51-1,000	Greater than 1,000	6
I.	Population served by aquifer supplies within 3 miles of site	0	1-50	51-1,000	Greater than 1,000	6

II. WASTE CHARACTERISTICS

A-1 Hazardous Waste Quantity

S = Small quantity (5 tons or 20 drums of liquid)
M = Moderate quantity (5 to 20 tons or 21 to 85 drums of liquid)
L = Large quantity (20 tons or 85 drums of liquid)

A-2 Confidence Level of Information

C = Confirmed confidence level (minimum criteria below)

- o Verbal reports from interviewer (at least 2) or written information from the records
- o Knowledge of types and quantities of wastes generated by shops and other areas on base

S = Suspected confidence level

- o No verbal reports or conflicting verbal reports and no written information from the records
- o Logic based on a knowledge of the types and quantities of hazardous wastes generated at the base, and a history of past waste disposal practices indicate that these wastes were disposed of at a site

A-3 Hazard Rating

Rating Factors	Rating Scale Levels 0	1	2	3
Toxicity	Sax's Level 0	Sax's Level 1	Sax's Level 2	Sax's Level 3
Ignitability	Flash point greater than 200°F	Flash point at 140°F to 200°F	Flash point at 80°F to 140°F	Flash point less than 80°F
Radioactivity	At or below background levels	1 to 3 times background levels	3 to 5 times background levels	Over 5 times background levels

Use the highest individual rating based on toxicity, ignitability, and radioactivity and determine the hazard rating.

Hazard Rating	Points
High (H)	3
Medium (M)	2
Low (L)	1

II. WASTE CHARACTERISTICS--Continued

Waste Characteristics Matrix

Point Rating	Hazardous Waste Quantity	Confidence Level of Information	Hazard Rating
100	L	C	H
	L	C	M
80	M	C	H
70	L	S	H
	S	C	H
60	M	C	M
	L	S	M
	L	C	L
50	M	S	H
	S	C	M
	S	S	H
	M	S	M
40	M	C	L
	L	S	L
	S	C	L
30	M	S	L
	S	S	M
20	S	S	L

Notes:
For a site with more than one hazardous waste, the waste quantities may be added using the following rules:

Confidence Level

- o Confirmed confidence levels (C) can be added.
- o Suspected confidence levels (S) can be added.
- o Confirmed confidence levels cannot be added with suspected confidence levels.

Waste Hazard Rating

- o Wastes with the same hazard rating can be added.
- o Wastes with different hazard ratings can only be added in a downgrade mode, e.g., MCM + SCH = LCM if the total quantity is greater than 20 tons.

Example: Several wastes may be present at a site, each having an MCM designation (60 points). By adding the quantities of each waste, the designation may change to LCM (80 points). In this case, the correct point rating for the waste is 80.

B. Persistence Multiplier for Point Rating

Persistence Criteria	Multiply Point Rating From Part A by the Following
Metals, polycyclic compounds, and halogenated hydrocarbons	1.0
Substituted and other ring compounds	0.9
Straight chain hydrocarbons	0.8
Easily biodegradable compounds	0.4

C. Physical State Multiplier

Physical state	Multiply Point Total From Parts A and B by the Following
Liquid	1.0
Sludge	0.75
Solid	0.50

III. PATHWAYS CATEGORY

A. Evidence of Contamination

Direct evidence is obtained from laboratory analyses of hazardous contaminants present above natural background levels in surface water, groundwater, or air. Evidence should confirm that the source of contamination is the site being evaluated.

Indirect evidence might be from visual observation (i.e., leachate), vegetation stress, sludge deposits, presence of taste and odors in drinking water, or reported discharges that cannot be directly confirmed as resulting from the site, but the site is greatly suspected of being a source of contamination.

B-1 Potential for Surface Water Contamination

Rating Factors	0	1	2	3	Multiplier
Distance to nearest surface water (includes drainage ditches and storm sewers)	Greater than 1 mile	2,001 feet to a mile	501 feet to 2,000 feet	0 to 500 feet	8
Net precipitation	Less than -10 inches	-10 to +5 inches	+5 to +20 inches	Greater than +20 inches	6
Surface erosion	None	Slight	Moderate	Severe	8
Surface permeability	0% to 15% clay ($>10^{-2}$ cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	Greater than 50% clay ($>10^{-6}$ cm/sec)	6
Rainfall intensity based on 1-year, 24 hour rainfall (thunderstorms)	<1.0 inch 0-5 0	1.0 to 2.0 inches 6-35 30	2.1 to 3.0 inches 36-49 60	>3.0 inches >50 100	8
B-2 Potential for Flooding					
Floodplain	Beyond 100-year floodplain	In 100-year floodplain	In 10-year floodplain	Floods annually	1
B-3 Potential for Groundwater Contamination					
Depth to groundwater	Greater than 500 feet	50 to 500 feet	11 to 50 feet	0 to 10 feet	8
Net precipitation	Less than -10 inches	-10 to +5 inches	+5 to +20 inches	Greater than +20 inches	6
Soil permeability	Greater than 50% clay ($>10^{-6}$ cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	15% to 30% clay 10^{-2} to 10^{-4} cm/sec	0% to 15% clay ($<10^{-2}$ cm/sec)	8
Subsurface flows	Bottom of site greater than 5 feet above high groundwater level	Bottom of site occasionally submerged	Bottom of site frequently submerged	Bottom of site located below mean groundwater level	8
Direct access to groundwater (through faults, fractures, faulty well casings, subsidence, fissures, etc.)	No evidence of risk	Low risk	Moderate risk	High risk	8

IV. WASTE MANAGEMENT PRACTICES CATEGORY

A. This category adjusts the total risk as determined from the receptors, pathways, and waste characteristics categories for waste management practices and engineering controls designed to reduce this risk. The total risk is determined by first averaging the receptors, pathways, and waste characteristics subscores.

B. Waste Management Practices Factor

The following multipliers are then applied to the total risk points (from A):

Waste Management Practice	Multiplier
No containment	1.0
Limited containment	0.95
Fully contained and in full compliance	0.10

Guidelines for fully contained:

Landfills:

- o Clay cap or other impermeable cover
- o Leachate collection system
- o Liners in good condition
- o Adequate monitoring wells

Surface Impoundments:

- o Liners in good condition
- o Sound dikes and adequate freeboard
- o Adequate monitoring wells

Spills:

- o Quick spill cleanup action taken
- o Contaminated soil removed
- o Soil and/or water samples confirm total cleanup of the spill

Fire Protection Training Areas:

- o Concrete surface and berms
- o Oil/water separator for pretreatment of runoff
- o Effluent from oil/water separator to treatment plant

General Note: If data are not available or known to be complete the factor ratings under items I-A through I, III-B-1, or III-B-3, then leave blank for calculation of factor score and maximum possible score.

Appendix D

Site Hazardous Assessment Rating Forms and Factor Rating Criteria

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE Fire Training Area - Site 1

LOCATION Kentucky Air National Guard, Louisville

DATE OF OPERATION OR OCCURRENCE 1958 to 1972

OWNER/OPERATOR 123rd TAW

COMMENTS/DESCRIPTION

SITE RATED BY HMTC

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 ft. of site	3	4	12	12
B. Distance to nearest well	2	10	20	30
C. Land use-zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	0	6	0	18
G. Groundwater use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by groundwater supply within 3 miles of site	1	6	6	18
		Subtotals	65	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 36

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) L

2. Confidence level (C = confirmed, S = suspected) C

3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B
100 x 0.8 = 80

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore
80 x 1.0 = 80

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: Surface water migration, flooding, and groundwater migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	0	8	0	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	64	108

Subscore (100 x factor score subtotal/maximum score subtotal) 59

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	3

Subscore (100 x factor score/3) 0

3. Groundwater migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to groundwater	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	1	8	8	24
Subsurface flows	1	8	8	24
Direct access to groundwater	0	8	0	24
		Subtotals	52	114

Subscore (100 x factor score subtotal/maximum score subtotal) 46

C. Highest pathway score
Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 59

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	36
Waste Characteristics	80
Pathways	59

Total 175 divided by 3 = 58
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

58 x 1.0 = 58

123rd Tactical Airlift Wing
Kentucky Air National Guard
Standiford Field
Louisville, Kentucky

USAF Hazard Assessment Rating Methodology
Factor Rating Criteria

Site No. 1 - Fire Training Area (FTA)

1. RECEPTORS CATEGORY	RATING SCALE LEVELS	NUMERICAL VALUE
Population within 1,000 feet of site	Greater than 100	3
Distance to nearest well	3,001 feet - 1 mile	2
Land use/zoning within 1 mile radius	Residential	3
Distance to installation boundary	0 - 1000 feet	3
Critical environments within 1 mile	Not a critical environment	0
Water quality of nearest surface water body	Agricultural or Industrial Use	0
Groundwater use of uppermost aquifer	Not used, other sources readily available	0
Population served by surface water supply within 3 miles downstream of site		0
Population served by groundwater supply within 3 miles of site	1-50	1

2. WASTE CHARACTERISTICS CATEGORY	RATING SCALE LEVELS	NUMERICAL VALUE
Quantity	Large quantity	L
Confidence Level	Confirmed	C
Hazard Rating:	High	H
Toxicity	Sax's Level 3	3
Ignitability	Flash point less than $80^{\circ}F$	3
Radioactivity	At or below background levels	0
Persistence Multiplier	Straight chain hydrocarbons	0.8
Physical State Multiplier	Liquid	1

123rd Tactical Airlift Wing
Kentucky Air National Guard
Standiford Field
Louisville, Kentucky

USAF Hazard Assessment Rating Methodology
Factor Rating Criteria (continued)

	PATHWAYS CATEGORY	RATING SCALE LEVELS	NUMERICAL VALUE
3.	PATHWAYS CATEGORY	RATING SCALE LEVELS	NUMERICAL VALUE
	Surface Water Migration:		
	Distance to nearest surface water	0 to 500 feet	3
	Net precipitation	+5 to +20 inches	2
	Surface Erosion	None	0
	Surface permeability	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	2
	Rainfall intensity	2.1 to 3.0 inches	2
	Flooding	Beyond 100 year flood plain	0
	Groundwater Migration:		
	Depth to groundwater	0 to 10 feet	3
	Net precipitation	+5 to +20 inches	2
	Soil permeability	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	1
	Subsurface flow	Bottom of site occasionally submerged	1
	Direct access to groundwater	No evidence of risk	0
4.	WASTE MANAGEMENT PRACTICES CATEGORY		
	Practice	No containment	1

Appendix E

Underground Storage Tank Inventory

Table 2. Underground Storage Tank Inventory, 123rd TAW, Kentucky Air National Guard, Standiford Field, Louisville, Kentucky

Location	5-1	5-2	5-3	6-1	6-2
Capacity (gallons)	4,000	4,000	100	25,000	25,000
Contents	MOGAS	MOGAS	Waste Oil	JP-4	JP-4
Year Installed	1958	1976	1971	1958	1958
Material of Construction	steel	steel	steel	steel	steel
Coatings A. Interior	undercoating	undercoating	unknown	Epoxy	Epoxy
B. Exterior	Bitumen	Bitumen	Bitumen	Bitumen	Bitumen
Cathodic Protection	Yes	Yes	Yes	Yes	Yes
Status of Tank (year abandoned)	Active	Active	Active	Active	Active

NOTES

- All containers have a sacrifical anode for cathodic protection.

Table 2. Underground Storage Tank Inventory, 123rd TAW, Kentucky Air
(continued) National Guard, Standiford Field, Louisville, Kentucky

Location	6-3	6-4	6-5	6-6	6-7
Capacity (gallons)	25,000	25,000	25,000	25,000	500
Contents	JP-4	JP-4	JP-4	JP-4	Waste Oil
Year Installed	1958	1958	1958	1958	1982
Material of Construction	steel	steel	steel	steel	steel
Coatings A. Interior	Epoxy	Epoxy	Epoxy	Epoxy	Undercoating
B. Exterior	Bitumen	Bitumen	Bitumen	Bitumen	Bitumen
Cathodic Protection	Yes	Yes	Yes	Yes	Yes
Status of Tank (year abandoned)	Active	Active	Active	Active	Active

NOTES

* All containers have a sacrifical anode for cathodic protection.

Table 2. Underground Storage Tank Inventory, 123rd TAW, Kentucky Air
(continued) National Guard, Standiford Field, Louisville, Kentucky

Location	10-1	25-1	25-2	25-3	25-4
Capacity (gallons)	12,000	8,000	300	1,000	400
Contents	Diesel	Diesel	Waste Oil	Water[1]	Detergent
Year Installed	1958	1976	1976	1976	1976
Material of Construction	steel	steel	steel	concrete	steel
Coatings A. Interior	Undercoating	Undercoating	Undercoating	Undercoating	Undercoating
B. Exterior	Bitumen	Bitumen	Bitumen	Undercoating	Bitumen
Cathodic Protection	Yes	Yes	Yes	Yes	Yes
Status of Tank (year abandoned)	Active	Active	Active	Active	Active

NOTES

- All containers have a sacrifical anode for cathodic protection.

[1] Container 25-3 is a settling tank.

Table 2. Underground Storage Tank Inventory, 123rd TAW, Kentucky Air National Guard, Standiford Field, Louisville, Kentucky (continued)

Location	26-1	2007-1	3002-1	3002-2
Capacity (gallons)	4,000	100	5,000	500
Contents	Diesel	Waste Oil	Oil/Water[2]	Waste Oil
Year Installed	1977	1974	1975	1975
Material of Construction	steel	steel	steel	steel
Coatings A. Interior	Undercoating	Unknown	Unknown	Unknown
B. Exterior	Bitumen	Bitumen	Bitumen	Bitumen
Cathodic Protection	Yes	Yes	Yes	Yes
Status of Tank (year abandoned)	Active	Active	Active	Active

NOTES

[1] All containers have a sacrifical anode for cathodic protection.
[2] Container 3002-1 is an oil/water separator.

Appendix F

Soil Borings

MILTON M. GREENBAUM ASSOCIATES, inc. • CONSULTING ENGINEERS

TEST BORING REPORT

CLIENT Luckett & Farley, Inc. P. N. 85073

PROJECT Telecom/Med Training & Administration Facility HOLE NO. 1

LOCATION See Boring Location Plan

DRILLER R. Baker LOGGED BY S. Greenbaum DATE STARTED 6/26/85

ELEVATION REFERENCE ______ DATE COMPLETED 6/26/85

DEPTH TO WATER: IMMEDIATELY ______; ______ DAYS AFTER ______

NOTES Type & Size of Hole Type of Bit or Spoon Loss of Drilling Water	DESCRIPTION & Classification of Materials	Depth	Samples for testing	Log	PENETRATION RESISTANCE (Blows per foot) ● Actual ○ Extrapolated 20 40 60 80	No. Blows & Core Recovery
	Topsoil					
Sample #1 @ 2'-3.5' Atterberg Limits: LL-27 PL-21 PI-6 A-4 CL & ML	Moist, Medium Stiff, Gray & Brown Mottled Sandy Silt with a little Clay	2.5'				2 3 4
Sample #2 @ 5'-6.5'	Same, Soft	5'				1 2 2
Sample #3 @ 7.7'-9.3'	7.7' Weathered New Albany Shale	7.5				
	Auger Refusal @ 9.3'					
6 1/2" O.D. Hollow Stem Auger Standard Penetration: 2" Split Spoon 140 lb. Hammer 30" Drop						

MILTON M. GREENBAUM ASSOCIATES, inc. • CONSULTING ENGINEERS

TEST BORING REPORT

CLIENT Luckett & Farley, Inc. P. N. 85073

PROJECT Telecom/Med Training & Administration Facility HOLE NO. 2

LOCATION See Boring Location Plan

DRILLER R. Baker LOGGED BY R. Baker DATE STARTED 6/26/85

ELEVATION REFERENCE ______ DATE COMPLETED 6/26/85

DEPTH TO WATER: IMMEDIATELY ______ ; ______ DAYS AFTER ______

NOTES Type & Size of Hole Type of Bit or Spoon Loss of Drilling Water	DESCRIPTION & Classification of Materials	Depth	Samples for testing	Log	PENETRATION RESISTANCE (Blows per foot) ● Actual ○ Extrapolated 20 40 60 80	No. Blows & Core	Recovery
	Topsoil						
Sample #1 @ 2'-3.5'	Moist, Medium Stiff, Gray & Brown Mottled Sandy Silt with a little Clay	2.5'				2	
						4	
						4	2(
Sample #2 @ 5'-6.5'	Same, Stiff	5'				5	
						6	
						7	1
	7.4' Weathered New Albany Shale	7.5'					
	Refusal @ 8.0'						
		10'					
6 1/2" O.D. Hollow Stem Auger Standard Penetration: 2" Split Spoon 140 lb. Hammer 30" Drop							

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MILTON M. GREENBAUM ASSOCIATES, inc. • CONSULTING ENGINEERS

TEST BORING REPORT

CLIENT Luckett & Farley, Inc. P. N. 85073

PROJECT Telecom/Med Training & Administration Facility HOLE NO. 3

LOCATION See Boring Location Plan

DRILLER R. Baker LOGGED BY R. Baker DATE STARTED 6/26/85

ELEVATION REFERENCE DATE COMPLETED 6/26/85

DEPTH TO WATER: IMMEDIATELY ; DAYS AFTER

NOTES Type & Size of Hole Type of Bit or Spoon Loss of Drilling Water	DESCRIPTION & Classification of Materials	Samples for testing	Log	PENETRATION RESISTANCE (Blows per foot) ● Actual ○ Extrapolated 20 40 60 80	No. Blows & Core Recovery
	Topsoil				
Sample #1 @ 2'-3.5'	Moist, Soft, Brown & Gray Sandy Silt with a little Clay				1 2 2
	2.5'				
Sample #2 @ 5'-6.5'	5'				2 1 2
	7.5'				
	7.8' Weathered New Albany Shale				
	Refusal @ 9.0'				
	10'				

6 1/2" O.D. Hollow Stem Auger
Standard Penetration:
2" Split Spoon
140 lb. Hammer
30" Drop

1119

MILTON M. GREENBAUM ASSOCIATES, inc. • CONSULTING ENGINEERS

TEST BORING REPORT

CLIENT Luckett & Farley, Inc. P. N. 85073

PROJECT Telecom/Med Training & Administration Facility HOLE NO. 4

LOCATION See Boring Location Plan

DRILLER R. Baker LOGGED BY R. Baker DATE STARTED 6/26/85

ELEVATION REFERENCE ______ DATE COMPLETED 6/26/85

DEPTH TO WATER: IMMEDIATELY ______ ; ______ DAYS AFTER ______

NOTES Type & Size of Hole Type of Bit or Spoon Loss of Drilling Water	DESCRIPTION & Classification of Materials	Depth	Samples for testing	Log	PENETRATION RESISTANCE (Blows per foot) ● Actual ○ Extrapolated 20 40 60 80	No. Blows & Core Recovery	
	Topsoil						
Sample #1 @ 2'-3.5'	Moist, Soft, Brown & Gray Mottled Sandy Silt with a little Clay	2.5'				1 2 3	2
Sample #2 @ 5'-6.5'	Same, Medium Stiff	5'				1 2 4	2
		7.5'					
	8.1' Weathered New Albany Shale						
		10'					
	Refusal @ 10.0'						
6 1/2" O.D. Hollow Stem Auger Standard Penetration 2" Split Spoon 140 lb. Hammer 30" Drop							

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TEST BORING REPORT

CLIENT: Luckett & Farley, Inc. — P. N.: 85073

PROJECT: Telecom/Med Training & Administration Facility — HOLE NO.: 5

LOCATION: See Boring Location Plan

DRILLER: R. Baker — LOGGED BY: R. Baker — DATE STARTED: 6/26/85

ELEVATION REFERENCE: ______ — DATE COMPLETED: 6/26/85

DEPTH TO WATER: IMMEDIATELY ______ ; ______ DAYS AFTER ______

NOTES Type & Size of Hole Type of Bit or Spoon Loss of Drilling Water	DESCRIPTION & Classification of Materials	Depth	Samples for testing	Log	PENETRATION RESISTANCE (Blows per foot) ● Actual ○ Extrapolated 20 40 60 80	No. Blows & Core Recovery	
	Topsoil						
ɔle #1 @ 2'-3.5'	Moist, Medium Stiff, Brown & Gray Mottled Sandy Silt with a little Clay	2.5'				2 4 6	1
ɔle #2 @ 5'-6.5'		5'				2 3 5	19
		7.5'					
	7.8' Weathered New Albany Shale						
	Refusal @ 8.5'	10'					
/2" O.D. Hollow Stem ɜr ıdard Penetration: Split Spoon lb. Hammer Drop							

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MILTON M. GREENBAUM ASSOCIATES, inc. • CONSULTING ENGINEERS

TEST BORING REPORT

CLIENT Luckett & Farley, Inc. P. N. 85073

PROJECT Telecom/Med Training & Adminstration Facility HOLE NO. 7

LOCATION See Boring Location Plan

DRILLER R. Baker LOGGED BY R. Baker DATE STARTED 6/26/85

ELEVATION REFERENCE DATE COMPLETED 6/26/85

DEPTH TO WATER: IMMEDIATELY ; DAYS AFTER

NOTES Type & Size of Hole Type of Bit or Spoon Loss of Drilling Water	DESCRIPTION & Classification of Materials	Samples for testing	Log	PENETRATION RESISTANCE (Blows per foot) ● Actual ○ Extrapolated 20 40 60 80	No. Blows % Core Recovery
	Topsoil				
Bag Sample @ 0-5'	Very Moist, Brown & Gray Sandy Silt with a little Clay 2.5'				
	5'				
	Terminated @ 5.0'				
6 1/2" O.D. Hollow Stem Auger					

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MILTON M. GREENBAUM ASSOCIATES, inc. • CONSULTING ENGINEERS

TEST BORING REPORT

CLIENT Luckett & Farley, Inc. P. N. 85073

PROJECT Telecom/Med Training & Administration Facility HOLE NO. 6

LOCATION See Boring Location Plan

DRILLER R. Baker LOGGED BY R. Baker DATE STARTED 6/26/85

ELEVATION REFERENCE ______ DATE COMPLETED 6/26/85

DEPTH TO WATER: IMMEDIATELY ______ ; ______ DAYS AFTER ______

NOTES Type & Size of Hole Type of Bit or Spoon Loss of Drilling Water	DESCRIPTION & Classification of Materials	Samples for testing	Log	PENETRATION RESISTANCE (Blows per foot) ● Actual ○ Extrapolated 20 40 60 80	No. Blows & Core Recovery
	Topsoil				
Bag Sample @ 0-5'	Moist, Brown & Gray Sandy Silt with a little Clay 2.5'				
	5'				
	Terminated @ 5.0'				
6 1/2" O.D. Hollow Stem Auger					